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SITE SPECIFIC HEALTH AND SAFETY PLAN FOR SOLID WASTE MANAGEMENT UNIT 38 (SWMU38) MISCELLANEOUS DITCHES IN INDUSTRIAL AREAS (SOUTHSIDE) ASSEMBLY E RFI WORK PLAN ASSEMBLY E MILLINGTON SUPPACT TN

9/20/1995

ENSAFE, INC.

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ASSEMBLY E — RFI WORK PLAN
NAVAL AIR STATION MEMPHIS

SITE-SPECIFIC HEALTH AND SAFETY PLAN
SWMU 38
MISCELLANEOUS DITCHES IN INDUSTRIAL AREAS (SOUTHSIDE)

CTO-106
Contract No. N62467-89-D-0318

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

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1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long Term Environmental Action Navy (CLEAN) program, the following Site Specific Health and Safety Plan (SSHSP) has been prepared for the RCRA Facility Investigation (RFI) at SWMU 38, Miscellaneous Ditches in Industrial Areas (South Complex), at the Naval Air Station (NAS) Memphis, Millington, Tennessee.

This plan is to be used in conjunction with the approved NAS Memphis Comprehensive Health and Safety Plan (CHASP). Copies of both this plan and the CHASP should be onsite during all field operations. The Navy project contract number with EnSafe/Allen & Hoshall (E/A&H) is N62467-89-D-0318, CTO-106.

Applicability

See CHASP Section 7.0.

Current Hazardous Waste Operators and Emergency Response (HAZWOPER) training certificates for E/A&H, E/A&H subcontractors, and United States Geological Survey (USGS) personnel anticipated to be conducting field work onsite, will be filed in the field trailer and available for review. Individuals whose certifications are not on file, or those who have a more recent certificate (have attended a refresher course), will provide the Onsite Supervisor with a copy of their certificate before being allowed to enter a work area.

Current OSHA refresher training certificates will be available, in the field trailer, for all employees involved in field activities if their refresher course requirements come up for renewal before the project begins. All subcontractors, DOD oversight personnel, and any other site visitors must provide health and safety certification with appropriate refresher course documentation prior to site entry.

2.0 SITE CHARACTERIZATION

2.1 Site Description

In its entirety, SWMU 38 covers most of the open ditches on NAS Memphis. The SWMU 38 ditches are used to drain the north and south sides of NAS Memphis; however, only the ditches which lie on the Southside of the base are included in this investigation.

Several drainage ditches have been included in other investigations at NAS Memphis, including SWMU 5 (Assembly A - Aircraft Fire Fighting Training Area); SWMUs 4, 6, 10, 31, and 38 (Assembly B Northside Drainage Ditches), and SWMUs 2 and 14 (Assembly E - Southside Landfill and Former Site of Building S-140 and Seventh Avenue Ditch, respectively).

The original design of many buildings at NAS Memphis (circa 1943) provided for floor drains which discharged to storm sewers, storm drains, and drainage ditches. As buildings were remodeled and replaced, these drains were eliminated or re-routed to the sanitary sewer. Until 1980, when most of these drains were replaced, it is reported that various substances, including solvents, degreasers, oils, and paints, may have been discharged to the drainage ditches.

2.2 Work Areas

See Section 7.1.1 of the CHASP for a description of the following work zones:

- Exclusion Zone (EZ),
- Contaminant Reduction Zone (CRZ), and
- Support Zone (SZ).

For a description of field activities to be conducted at the site and within each work area see the Site Investigation Plan (SIP).

2.3 Work Area Access

Authorized personnel will be allowed access to work areas as long as they follow the requirements of this SSHSP and the CHASP. See also Work Area Access, Section 7.1.2 of the CHASP.

2.4 Site Map and Work Zones

The location of the site is shown in Figure 1, the vicinity map. A site map, with proposed sampling locations at SWMU 38 is shown in Figure 2. The EZ, CRZ, and SZ locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. Figure 3 provides a typical example of how work zones will be established at a site.

3.0 SITE ACTIVITIES

Site activities will include soil sampling (via hand auger), soil borings, and groundwater monitoring well installations. Subsequent activities will include well development, purging, and sampling as required. Field work is described in the Comprehensive RFI Work Plan.

4.0 CHEMICAL HAZARDS

Previous sampling operations and site history show a potential for exposure to various chemical contaminants. Table 1 lists exposure guidelines for potential site chemicals.

5.0 OPERATIONS AND PHYSICAL HAZARDS

Physical hazards typically encountered during environmental investigations will be present at this site. These hazards include heat-related illnesses, uneven terrain, slippery surfaces, waterborne operations, lifting, and use of heavy equipment. The Site Supervisor and Site Health and Safety Officer shall be aware of the potential for heat stress and other weather-related illnesses, and as necessary, implement appropriate work regimens to minimize the likelihood of field personnel becoming ill.

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Figure 1 Vicinity Map

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Figure 2 Proposed Sampling Locations

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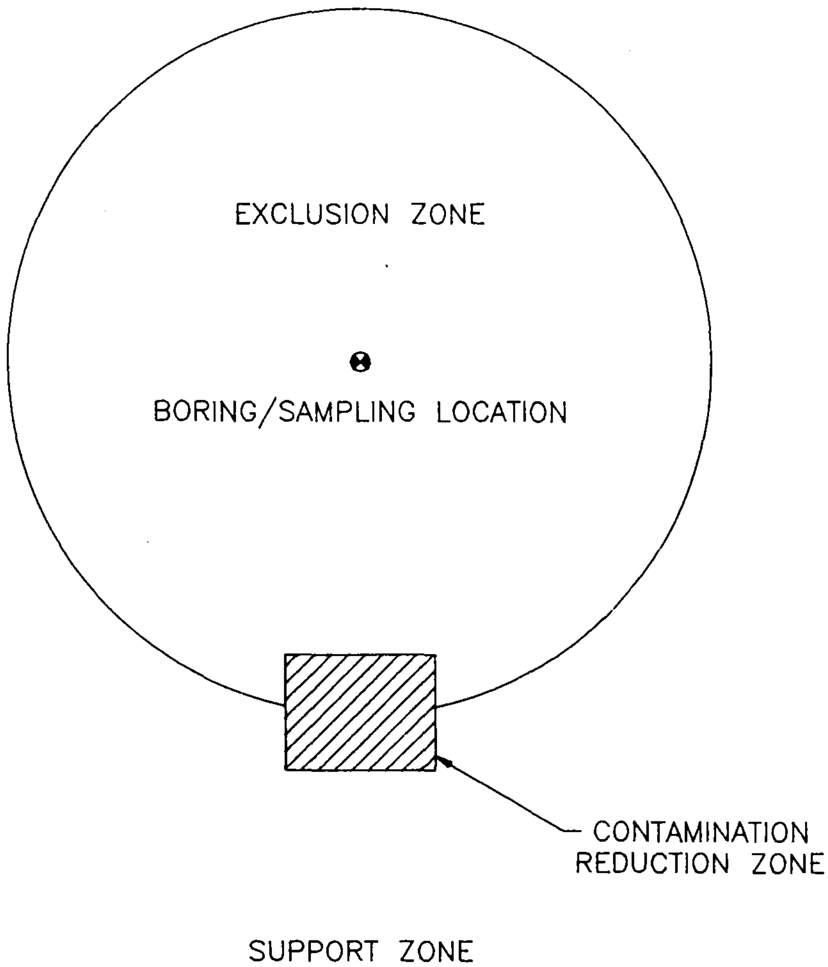

NOT TO SCALE

RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TN

FIGURE 3
SITE WORK ZONES

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Table 1
Exposure Guidelines For Expected Site Chemical Hazards

Chemical Name	Odor Threshold[a] (ppm)	OSHA PEL[b] (mg/m^3)	ACGIH TLV[c] (mg/m^3)	NIOSH REL[d] (mg/m^3)	Action Level[e] (mg/m^3)	Flammable Range (% by Volume)
Lead	N.A.	0.05	0.15	0.103	0.025	N.A.
Cadmium	N.A.	0.005	0.05	0.01	0.0025	N.A.
Arsenic	N.A.	0.01 mg/m^3	Not Listed	0.01 mg/m^3	0.005 mg/m^3	N.A.
DDT	N.A.	1 mg/m^3	1 mg/m^3	0.5 mg/m^3	0.25 mg/m^3	N.A.
DDE	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
DDD	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed	Not Listed
Chlordane	Not Listed	0.5 mg/m^3	0.5 mg/m^3	Potential Occupational Carcinogen	0 .25 mg/m^3	0.7 to 5.0%
Dieldrin	0.041	0.25 mg/m^3	0.25 mg/m^3	Lowest Feasible Concentratio n	0.13 mg/m^3	N.A.
Tetrachloro-ethylene	5	25	25 100 STEL	Lowest Feasible Concentratio n	12.5	Not Listed
Trichloro-ethylene	50	50 200 STEL	50 100 STEL	25	12.5	8 to 10.5%
1,1-Dichloro-ethylene	Not Listed	1	5 20 STEL	Not Listed	0.5	7.3 to 16%
1,2-Dichloroethane	100	1 2 STEL	10	1 2 STEL	0.5	6.2 to 15.6%
Methyl Ethyl Ketone	10	200 300 STEL	200 300 STEL	200	100	1.8 to 11.5%
Acetone	100	750 1000 STEL	750 1000 STEL	250	125	2.6 to 12.8%
Methylene Chloride	214	500 1000 STEL	50	Lowest Feasible Concentratio n	25	12 to 19%
Chromium	N.A.	1	0.5	0.5	0.25	N.A.

Notes:

[a] Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values

[b] 29 CFR 1910.1000, Table Z-1-A. Limits For Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit)

[c] 1990 - 1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienist. (STEL = Short Term Exposure Limit)

[d] NIOSH Pocket Guide to Chemical Hazards, June 1990. (REL = Recommended Exposure Limit)

N.A. — Substance information not available, or substance unlisted.
NIOSH — National Institute of Occupational Safety and Health.

Material Safety Data Sheets (MSDS) for these materials are included in Attachment A.

Heavy equipment and drill rig operations will be conducted in accordance with the procedures outlined in the CHASP, Attachment B, Drilling Safety Guide. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling. If working in areas supporting habitat for poisonous snakes, personnel should wear protective chaps made of a heavy material designed to prevent snake bites to the legs.

6.0 EMPLOYEE PROTECTION

Employee protection for this project includes standard safe work practices, NAS Memphis rules of conduct, personal protective equipment (PPE), personal decontamination procedures, and equipment for extreme weather conditions, work limitations, and exposure evaluation.

6.1 Standard Safe Work Practices:

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the Site Health and Safety Officer.

- Hands and face must be thoroughly washed upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate or discolored surfaces, or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.

- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to ensure that the drill rig boom does not touch or pass close to any overhead lines.

- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), the activity and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.

- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

6.2 NAS Memphis General Rules of Conduct:

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.

- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.

- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.

- Willfully damaging or destroying property, or removing government records is forbidden.

- Misappropriation or unauthorized altering of any government records is forbidden.

- Securing government tools in a personal or contractors tool box is forbidden.

- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc. is forbidden.

- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.

- Compliance with posted signs and notices is required.

- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.

- Fighting or threatening bodily harm to another is forbidden.

- Defacing any government property is forbidden.

- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes and pants or slacks, or coverall-type garments will be worn at all times on government property.

- All persons operating motor vehicles will obey all NAS Memphis traffic regulations.

6.3 Selection of Personal Protective Equipment

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on past experiences and sound safety practices.

The Project Health and Safety Officer will determine the appropriate level of PPE prior to the initial site entry based on the best available information. PPE requirements are subject to change as site information is updated or changes. **The decision to upgrade or downgrade levels of PPE shall be made by the Project Health and Safety Officer.**

Field activities which disturb soils will be initiated in modified Level D protection except when stated otherwise in the SSHSP or when site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consists of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel-toed and shank boots. Work coveralls (full length sleeves and pants) will be worn if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the concentrations of contaminants detected in previous the studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceed 2 ppm above the background concentration in the breathing zone or if the concentration of any contaminant exceeds 50% of the OSHA Permissible Exposure Limit (PEL). See Table 2 for the specific criteria for use and equipment for each level of protection.

6.4 Air Monitoring

Previous site investigations indicate that workers may potentially be exposed to low concentrations of chemicals including VOCs, halogenated compounds, and combustible gases/vapors. Based on site history and existing sampling data, "worst case" contaminated areas will be identified before field activities begin.

Air monitoring using a photoionization detector (PID) and/or other appropriate sampling equipment will be conducted prior to beginning field activities at a new EZ and during ground-disturbing activities. The PID will be field calibrated to measure VOCs relative to a 100 ppm isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to determine the identification and approximate concentration of these compounds.

Table 2
Level Of Protection And Criteria

Level of Protection	Criteria for Use	Equipment
Level A	• When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) • When known atmospheres or potential situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. • Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. • Where atmospheres are oxygen deficient with the conditions above • When the type(s) and or potential concentration of toxic substances are not known	• Positive pressure-demand full facepiece; self-contained breathing apparatus (SCBA) or positive pressure-demand supplied air respirator with escape SCBA • Totally encapsulating chemical protective suit • Chemical-resistant inner and outer gloves • Steel-toe-and-shank chemical resistant boots • Hard hat under suit • Two-way radios worn inside suit • Coveralls, long cotton underwear, disposable protective suit, gloves and boots, worn over fully encapsulating suit
Level B	• When work areas contain less than 19.5% oxygen • When vinyl chloride is detected in the breathing zone	• Chemical resistant clothes, long sleeves, hooded, one or two pieces • Full-faced positive-pressure demand supplied air breathing apparatus or airline system with a 30-minute escape bottle • Hard hat • Inner gloves and chemical resistant gloves • Steel-toe-and-shank boots • Coveralls and disposable outer boots
Level C	• When airborne dust particles warrant respiratory protection • When work areas contain at least 19.5% oxygen	• Chemical resistant clothes, long sleeves, hood optional, one or two pieces • Full-face piece, air purifying respirator equipped with cartridges suitable for the hazard • Hard hat • Inner gloves and chemical resistant gloves • Steel-toe-and-shank boots • Coveralls and disposable outer boots
Level D	• When level B or C is not indicated • When airborne particles do not warrant respiratory protection • When work areas contain at least 19.5% oxygen	• Inner gloves and chemical-resistant gloves needed to handle soil or water samples • Steel-toe-and-shank boots • Hard hat (ANSI Z891-1969 standard) • Eye protection (ANSI Z87.1-1968) standard • Sunscreen (SPF 15 or greater) • Coveralls and disposable outer boots

Notes:

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed. Level A protection will be required in Area A of the exclusion zone.

Contraindications for use of Level A:
- Environmental measures contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body, (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(i) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material are known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 mg/m3 or the total concentrations exceed the PEL of 15 mg/m3.

Level D protection will be chosen when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.

A combustible gas indicator (CGI) will be used during all soil borings and well installations. The CGI will be field calibrated to measure flammable gases relative to a 23% lower explosive limit (LEL) methane standard. Downhole CGI readings will be collected continuously during all soil disturbing operations. Field activities will immediately cease if downhole readings exceed 10% LEL. If CGI readings do not subside, a careful investigation and mapping of the area will be made. Operations may not proceed until readings are below 10% LEL. The area will be immediately evacuated and the situation re-evaluated to determine how to proceed.

If breathing zone levels exceed 2 ppm above background or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact both the Project Manager and the Project Health and Safety Officer. The Project Health and

Safety Officer will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) See Table 2 for specific criteria for each protection level. Work shall not proceed until breathing zone levels return to background levels and it is reasonably anticipated that breathing zone samples will stay approximately at background levels, or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

On a daily basis, PIDs, CGIs, and other monitoring equipment shall be calibrated or their proper function verified before being used. Throughout the day this equipment shall be periodically checked to ensure that it is working properly. A final calibration shall be conducted at the end of the work day, at which time each instrument will be checked to ensure that it is free from surface contamination. Field staff shall note in their field notebooks that they conducted these calibrations and checks and note whether the equipment was or was not functioning properly. When equipment is not functioning properly it should be brought to the attention of the Site Supervisor or Site Health and Safety Officer who will arrange for repairs and/or replacement of that equipment as needed.

6.5 Procedures and Equipment for Extreme Hot or Cold Weather Conditions

See CHASP Section 7.5.5.

Severe Weather Conditions

All field work shall immediately cease at the first sign of thunder or lightning. Field personnel shall perform emergency personal and equipment decontamination (see Section 6.6) and seek immediate shelter.

6.6 Personal Decontamination

A CRZ will be established immediate to each sampling/boring site and will include a station for decontaminating equipment and personnel. The CRZ will be covered with sheets of 6-mil polyethylene (typically an area 20 feet x 20 feet is sufficient) with specific stations that will accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection if required.

As a general rule, equipment will be decontaminated using a soap and clean water wash solution. Equipment decontamination will be completed by personnel in Level D PPE. In the event of inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, all contaminated equipment will be wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Personnel working in the CRZ will be in one Level of PPE lower than personnel in the EZ. For example, if personnel in the EZ are in Level B, decontamination workers will be in Level C.

6.6.1 Personal Decontamination Procedures

The decontamination procedures, based on modified Level D protection, will consist of the following:

- Brush heavily soiled boots and rinse outer gloves and boots with soap and water.

- Remove outer gloves and deposit them in a labeled plastic-lined container.

- Remove outer chemical protective clothing.

- Wash and rinse inner gloves.

- Wash hard hats and eye protection thoroughly at the end of each work day with a soap and water solution.

- Dispose of gloves and other disposable clothing in sealable bags and place in a labeled 55-gallon drum for disposal.

- Field personnel are instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each work day. If higher levels of PPE are needed, adjustments will be made to these procedures, and an amendment will be made to this SSHSP.

All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums. The drums will be labeled by USGS personnel for final disposal by the Navy.

6.6.2 Closure of the Personal Decontamination Station

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed of in a labeled refuse container. Decontamination and rinse solutions will be placed in a labeled 55-gallon drum for later analysis and disposal. All washtubs, pails, buckets, etc. will be washed, rinsed, and dried at the end of each workday.

6.7 Work Limitations

All site activities will be conducted during daylight hours only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as specified in 29 CFR 1910.120(e). All supervisors must complete an additional 8 hours of training in site management. All personnel must complete an 8-hour refresher training course on an annual basis in order to continue working at the site.

6.8 Exposure Evaluation

All personnel scheduled for site activities will have had a baseline physical examination and have been declared fit for duty. The exam includes a stressing exam of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel and urinalysis. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated on an annual basis and upon termination of employment as required by 29 CFR 1910.120(f). The content of the annual or termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or any job restrictions. The Site Health and Safety Officer will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

7.0 MEDICAL MONITORING PROGRAM

See CHASP Section 7.6.

8.0 AUTHORIZED PERSONNEL

Personnel anticipated to be onsite at various times during site activities include:

- Principal-In-Charge — Dr. James Speakman (E/A&H)
- Task Order Manager/Project Manager — Mr. Lawson Anderson (E/A&H)
- Project Health & Safety Officer — Mr. Doug Petty (E/A&H)
- Field Environmental Scientist — Mr. Robert Smith (E/A&H)
- Field Environmental Scientist — Ms. Allison Choate (E/A&H)
- Engineer-in-Charge — Mr. Mark Taylor (SOUTHDIV)
- USGS Personnel — Mr. William Parks, Mr. Jack Carmichael, Mr. James Kingsbury
- Naval Air Station Memphis, Tennessee Site Contact — Ms. Tonya Barker

8.1 Responsibilities of Site Supervisor

The Site Supervisor will direct the site operations and, relative to health and safety, is responsible for assuring that:

- Field staff follow the CHASP, SSHSP, and other safety and health standard operating procedures (SOPs). Personnel that do not comply are retrained and/or instructed to leave the site and not allowed to return.
- Field staff have current HAZWOPER training.
- Field staff know who the Site Health and Safety Officer is.
- Field staff know the site specific safety and health concerns.
- There is an adequate onsite supply of health and safety equipment.
- Field staff participate in the E/A&H Medical surveillance program (or in the case of the USGS or subcontractors, an equivalent program).
- Field staff attend safety and health "kick-off" orientation and other site safety briefings.

The Site Supervisor is also responsible for assuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

8.2 Responsibilities of Site Health and Safety Officer

The responsibilities of the Site Health and Safety Officer include:

- Providing the Site Supervisor technical input on site health and safety issues.
- Observing field personnel and reporting to the Site Supervisor on the effectiveness of the CHASP and SSHSP and whether field staff are utilizing proper work practices and decontamination procedures.
- Reporting significant safety violations to the Project Manager and/or Project Health and Safety Officer.
- Conducting safety briefings during field activities.
- Assuring that copies of the CHASP and SSHSP are maintained onsite during all field activities.
- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel.

The Site Health and Safety Officer will have the following qualifications: (1) 40 hours OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific work tasks being conducted, and (4) shall be trained to use the air monitoring equipment; be able interpret the data collected with the instruments; be familiar with symptoms of chemical exposure, heat stress and cold exposure, and know the location and proper use of onsite safety equipment. He will also be familiar with the CHASP and SSHSP.

The position of Site Health and Safety Officer may rotate. Often, particularly on small projects, this function is not a full time responsibility, rather a member of the field team is selected to serve as the Site Health and Safety Officer. Then when that task is completed and/or field staff change, the Site Health and Safety Officer may change as well.

The following criteria outline when the Site Health and Safety Officer will be replaced: (1) termination of employment, (2) end of work task, (3) end of shift, (4) sickness, (5) injury, or (6) death. It should be noted that under site work schedules only one shift will be working. As a result, the Site Health and Safety Officer will be responsible for the day shift. If circumstances arise that require work during other periods, an alternate Site Health and Safety Officer will be designated.

8.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with the CHASP and SSHSP.

- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards and what to do when these hazards are encountered.

- Being properly trained on PPE to be used, safety work practices, decontamination procedures to be followed, and emergency procedures and communications.

- Utilizing required PPE including respiratory protective.

- Having up to date HAZWOPER training and providing the Site Supervisor with documentation that their training is current.

- Being an up to date participant in an acceptable medical surveillance program.

- Being fit-tested and physically capable of using a respirator and being in a position where using a respirator may be a requirement. Should the use of respiratory protection be required, field workers shall not have facial hair which intrudes into the sealing surface of the respirator.

- Using the buddy system when wearing respiratory protective equipment. When working in Level C or higher, a third person shall be at the work area. This person shall be suitably equipped to provide logistical and safety support to the entry team.

In addition, field staff should always be alert and use their senses (sight, smell, etc.,) to identify and react to potentially dangerous situations. When working in the EZ, visual contact should be maintained between personnel; field personnel should be close enough to assist each other during an emergency. Procedures for leaving a contaminated area must be planned and implemented before going onsite in accordance with the CHASP and SSHSP.

The number of personnel and equipment in the contaminated area should be kept to a minimum, consistent with effective site operations. All visitors to the job site must comply with the CHASP and SSHSP procedures. PPE may be modified for visitors depending on the situation. Modifications must be approved by the Project Health and Safety Officer.

9.0 EMERGENCY INFORMATION

All hazardous waste site activities present a potential risk to onsite personnel. During routine operations risk is minimized by establishing good work practices, staying alert, and using proper

PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support service, Tonya Barker, NAS Memphis Site Contact, will be informed and the appropriate contact from the following list will be made:

Contact	**Agency or Organization**	**Telephone**
Tonya Barker	NAS Memphis	(901) 873-5461/5462
Mark Taylor	SOUTHDIV EIC	(803) 743-0573
Law Enforcement	NAS Memphis Base Security	9-911
Fire Department	NAS Memphis	9-911
Ambulance Service	Naval Hospital, Millington Navy Road	(901) 873-5801/5802 or 9-911
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911
Southern Poison Control Center	—	(901) 528-6048
Lawson Anderson	EnSafe/Allen & Hoshall	(901) 372-7962
Doug Petty	EnSafe/Allen & Hoshall	(901) 372-7962

Mark Taylor, SOUTHDIV Engineer-in-Charge (EIC) will be contacted after appropriate emergency measures have been initiated onsite.

9.1 Site Resources

Cellular telephones may be used for emergency use and communication/coordination with NAS Memphis. First aid and eye wash equipment will be available at the work area.

9.2 Emergency Procedures

Conditions which may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite or if a condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the Site Health and Safety Officer. Copies of the emergency contacts and routes will be posted onsite.

- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately stop work and act according to the instructions provided by the Site Health and Safety Officer.

- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the Site Health and Safety Officer to indicate possible routes for upwind escape.

- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the Site Health and Safety Officer has evaluated the situation and provided the appropriate instructions to the field team.

- If an accident occurs, the Field Project Manager is to complete an Accident Report Form (See Attachment C) for submittal to the managing principal-in-charge of the project.

- If a member of the field crew suffers a personal injury, the Site Health and Safety Officer will call **(901) 372-5211 or 9-911** (serious injury) to alert appropriate emergency response agencies or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.

- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the Site Health and Safety Officer should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (See Attachment D for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through Material Safety Data Sheets (MSDS) in Attachment A.

10.0 FORMS

The following forms will be used to implement this Health and Safety Plan:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

The Plan Acceptance Form will be filled out by all employees working on the site before site activities begin. The Plan Feedback Form will be filled out by the Site Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Field Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Attachment C of this plan.

All completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

Attachment A

Material Safety Data Sheets

Attachment B

Drilling Safety Guide

Attachment C

Health and Safety Plan Forms

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site and returned to: EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: CTO — 106

Contract No: N62467-89-D-0318

Project: SWMU 38 — Miscellaneous Ditches in Industrial Areas (Southside)

I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

____

Signed

____

Print Name

____

Company

____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: ______________________________

Job Name: ______________________________

Date(s) From/To: ______________________________

Hours On Site: ______________________________

Contaminants (Suspected/Reported):

____

____

____

____

____

____

____

____

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____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

[redacted]

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)

NAME OF INJURED OR ILL WORKER AND COMPANY		
WORKER'S SOCIAL SECURITY NUMBER		
DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT	
NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐	LOST WORK DAY WITH _____DAYS AWAY FROM WORK	LOST WORK DAY WITH _____DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY ☐ FIRST-AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR (Print)	TITLE
	DATE

Attachment D

Directions to Emergency Medical Facilities

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

The nearest hospital **and** the nearest facility capable of treating chemical burns are the same facility, which is located at Methodist North Hospital. Therefore, there is only one set of directions.

Nearest Hospital
Methodist North Hospital **3960 Covington Pike** **Memphis, Tennessee**
Emergency Room Telephone Number — (901) 372-5211

Directions to Methodist North Hospital from NAS Memphis Main Gate:

1) Exit site through South Gate (Singleton Parkway).

2) Continue on Singleton Parkway through the stop signs.

3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).

4) You will see the entrance to the emergency room 700 feet past this light on the left.

INSERT MAP TO HOSPITAL

HASP
38

Attachment A

Material Safety Data Sheets

CHEMTOX DATA

------------------------------ IDENTIFIERS ------------------------------

CHEMTOX RECORD 247 LAST UPDATE OF THIS RECORD: 06/03/93
NAME: LEAD
SYNONYMS: C.I. PIGMENT METAL 4; C.I. 77575; KS-4; LEAD FLAKE; LEAD S2; OLOW (Polish); SI; SO
CAS: 7439-92-1 RTECS: OF7525000
FORMULA: Pb MOL WT: 207.19
WLN: PB
CHEMICAL CLASS: Metal

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ------------------------------

PHYSICAL DESCRIPTION: bluish-grey, soft metal; heavy ductile, soft, gray solid

BOILING POINT:	2013 K	1739.8 C	3163.7 F
MELTING POINT:	600.6 K	327.4 C	621.4 F

FLASH POINT: Not available
AUTO IGNITION: Not available
VAPOR PRESSURE: 1mm @ 973 C
UEL: ~
LEL: ~
VAPOR DENSITY: No data
SPECIFIC GRAVITY: 11.34
DENSITY: 11.34 g/mL @ 20 C
WATER SOLUBILITY: INSOLUBLE; DISSOLVES SLOWLY IN WATER CONTAINING A WEAK ACID
INCOMPATIBILITIES: strong ox, hydrogen peroxide, active metals, sodium, potassium, chlorine trifluoride, hydrogen peroxide, zirconium, disdium acetylide, oxidants

REACTIVITY WITH WATER: No data on water reactivity
REACTIVITY WITH COMMON MATERIALS: RELATIVELY IMPENETRABLE TO RADIATION
STABILITY DURING TRANSPORT: No Data
NEUTRALIZING AGENTS: No data
POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: WHEN HEATED EMITS HIGHLY TOXIC FUMES; CAN REACT VIGOROUSLY WITH OXIDIZING MATERIALS
ODOR DETECTED AT (ppm): Unknown
ODOR DESCRIPTION: No data
100 % ODOR DETECTION: No data

------------------------------ REGULATIONS ------------------------------

National Primary Ambient Air Quality Standards
1.5 ug/M3 maximum arithmetic mean averaged over a calendar year
National Secondary Ambient Air Quality Standards
same as primary standard

DOT hazard class: 6.1 POISON
DOT guide: 53
Identification number: UN2291
DOT shipping name: LEAD COMPOUNDS, SOLUBLE, N.O.S.
Packing group: III
Label(s) required: KEEP AWAY FROM FOOD
Special provisions:
Packaging exceptions: 173.153
Non bulk packaging: 173.213
Bulk packaging: 173.240
Quantity limitations-
Passenger air/rail: 100 KG
Cargo aircraft only: 200 KG
Vessel stowage: A
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): Treatment technique (12/07/92)
Maximum Contaminant Level Goals (MCLG): 0 mg/L (12/07/92)
CLEAN AIR ACT: CAA '90 By category and CAA '77 Sect 109
EPA WASTE NUMBER: D008
CERCLA REF: Y
RQ DESIGNATION: A 10 pounds (4.54 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Chronic toxicity: carcinogen
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: ORM-B
Mailability: Domestic service and air transportation; shipper's declaration
Max per parcel: 25 LBS; 5 LBS

NFPA CODES:
HEALTH HAZARD (BLUE): Unspecified

FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified
SPECIAL : Unspecified

SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON

ACGIH TLV list "Threshold Limit Values for 1992-1993"
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
California Proposition 65 Developmental Toxin List
California Proposition 65 Female Reproductive Toxin List
California Proposition 65 Male Reproductive Toxin List
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 109 National Ambient Air Quality Standards List
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
LEAD [7439-92-1]
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a teratogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Specifically regulated substance. See 29 CFR 1910.1025
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 313 Toxic Chemicals List

TOXICITY DATA

SHORT TERM TOXICITY: LASSITUDE, INSOMNIA, PALLOR, EYE GROUNDS, ANOREXIA, LOW-WEIGHT, MALNUTRITION, CONSTIPATION, ABDOMINAL PAIN, COLIC; HYPOTENSE, ANEMIA; GINGIVAL LEAD LINE; TREMBLING PARALYSIS WRIST. ** Source: 2

LONG TERM TOXICITY: unknown

TARGET ORGANS: gi,CNS,kidneys,blood,gingival tissue

SYMPTOMS: LASS, INSOM, PAL, EYE GROUNDS, ANOR, LOW-WT, MALNUT, CONSTI, ABDOM PAIN, COLIC; HYPOTENSE, ANEMIA, GINGIVAL LEAD LINE; TREM, PARA WRIST. METALLIC TASTE, INCREASED SALIVATION, PYORRHEA (FLOW OF MUCOUS). NEUROMUSCULAR: NUMBNESS AND TINGLING OF EXTREMITIES WITH SENSORY

DISTRUBANCE, EXTENSOR WEAKNESS OF WRISTS AND ANKLES, LOSS OF MUSCLE TONE, TREMOR INCREASED DEEP-TENDON REFLEXES, MUSCULAR CRAMPS AND ACHING, MUSCULAR ATROPHY. CNS: VISUAL DISTURBANCES, HEADACHE, NERVOUSNESS OF DEPRESSION, INSOMNIA, MENTAL CONFUSION, DELIRIUM. Source: NIOSHP, THIC

CONC IDLH: 100mg/m3(ASPb)

NIOSH REL: <0.1 mg/M3 Air level to be maintained so that worker blood level remains <0.06 mg/100 g of whole blood

ACGIH TLV: TLV = 0.15mg/M3 as LEAD
ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:
TWA = See 29 CFR 1910.1025 and 1926.62
50 ug/M3

MAK INFORMATION: 0.1 mG/M3
Substance with systemic effects, onset of effect over 2 hours: Peak = 10xMAK for 30 minutes, once per shift of 8 hours.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:
IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Animal carcinogen. The chemical is carcinogenic in experimental animals at a relatively high dose, by routes or administration, at sites, or histological types, or by mechanisms that are not considered relevant to worker exposure.
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
orl-wmn TDLo:450 mg/kg/6Y JAMAAP 237,2627,77
PERIPHERAL NERVE AND SENSATION
Flaccid paralysis without anesthesia
BEHAVIORAL
Hallucinations, distorted perceptions
BEHAVIORAL
Muscle weakness

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

ipr-rat LDLo:1 gm/kg
orl-pgn LDLo:160 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:790 mg/kg (multigenerations) AEHLAU 23,102,71
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-rat TDLo:1140 mg/kg (14D pre-21D post) PHMCAA 20,201,78
EFFECTS ON NEWBORN
Behavioral

orl-rat TDLo:520 mg/kg (7-22D preg/10D post) FEPRA7 37,394,78
EFFECTS ON NEWBORN

orl-rat TDLo:1100 mg/kg (1-22D preg) FEPRA7 37,895,78
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Blood and lymphatic systems(including spleen and marrow)
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

ihl-rat TCLo:10 mg/m3/24H (1-21D preg) ZHPMAT 165,294,77
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Blood and lymphatic systems(including spleen and marrow)

ihl-rat TCLo:3 mg/m3/24H (1-21D preg) ZHPMAT 165,294,77
EFFECTS ON NEWBORN

orl-mus TDLo:1120 mg/kg (multigenerations) AEHLAU 23,102,71

EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-mus TDLo:6300 mg/kg (1-21D preg) EXPEAM 31,1312,75
EFFECTS ON FERTILITY
Female fertility index
EFFECTS ON FERTILITY
Pre-implantation mortility

orl-mus TDLo:300 mg/kg (1-2D preg) TXCYAC 6,129,76
EFFECTS ON FERTILITY
Other measures of fertility

orl-mus TDLo:4800 mg/kg (1-16D preg) BECTA6 18,271,77
EFFECTS ON EMBRYO OR FETUS
Cytological changes(including somatic cell genetic material)

orl-dom TDLo:662 mg/kg (1-21W preg) TXAPA9 25,466,73
EFFECTS ON NEWBORN
Behavioral

California Prop 65: Developmental toxin (02/27/87)
Female reproductive toxin (02/27/87)
Male reproductive toxin (02/27/87)
Acceptable intake level-inhalation .5 ugD (01/01/94)
Carcinogen (10/01/92)

--------------------------- EPA's IRIS DATA SUMMARY ------------------------
Lead and compounds (inorganic); CASRN 7439-92-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Lead and compounds (inorganic)
CASRN -- 7439-92-1
Last Revised -- 05/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quant-itative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Sufficient animal evidence. Ten rat bioassays and one mouse assay have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Animal assays provide reproducible results in several laboratories, in multiple rat strains with some evidence of multiple tumor sites. Short term studies show that lead affects gene expression. Human evidence is inadequate.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. There are four epidemiologic studies of occupational cohorts exposed to lead and lead compounds. Two studies (Dingwall-Fordyce and Lane, 1963; Nelson et al., 1982) did not find any association between exposure and cancer mortality. Selevan et al. (1985), in their retrospective cohort mortality study of primary lead smelter workers, found a slight decrease in the total cancer mortality (SMR=95). Apparent excesses were observed for respiratory cancer (SMR=111, obs=41, $p>0.05$) and kidney cancer (SMR=204, obs=6, $p>0.05$). Cooper and Gaffey (1975) and Cooper (1985 update) performed a cohort mortality study of battery plant workers and lead smelter workers. They found statistically significant excesses for total cancer mortality (SMR=113, obs=344), stomach cancer (SMR=168, obs=34), and lung cancer (SMR=124, obs=109) in the battery plant workers. Although similar excesses were observed in the smelter workers, they were not statistically significant. Cooper and Gaffey (1975) felt it was possible that individual subjects were monitored primarily on the basis of obvious signs of lead exposure, while others who showed no symptoms of lead poisoning were not monitored.

All of the available studies lacked quantitative exposure information, as well as information on the possible contribution from smoking. All studies also included exposures to other metals such as arsenic, cadmium, and zinc for which no adjustment was done. The cancer excesses observed in the lung and stomach were relatively small (<200). There was no consistency of site among the various studies, and no study showed any dose-response relationship. Thus, the available human evidence is considered to be inadequate to refute or demonstrate any potential carcinogenicity for humans from lead exposure.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. The carcinogenic potential of lead salts (primarily phosphates and acetates) administered via the oral route or by injection has been demonstrated in rats and mice by more than 10 investigators. The most characteristic cancer response is bilateral renal carcinoma. Rats given lead acetate or subacetate orally have developed gliomas, and lead subacetate also produced lung adenomas in mice after i.p. adminstration. Most of these investigations found a carcinogenic response only at the highest dose. The lead compounds tested in animals are almost all soluble salts. Metallic lead, lead oxide and lead tetralkyls have not been tested adequately. Studies of inhalation exposure have not been located in the literature.

Azar et al. (1973) administerd 10, 50, 100, and 500 ppm lead as lead acetate in dietary concentrations to 50 rats/sex/group for 2 years. Control rats (100/sex) received the basal laboratory diet. In a second 2-year feeding study, 20 rats/group were given diets containing 0, 1000, and 2000 ppm lead as lead acetate. No renal tumors were reported in the control groups or in treated animals of either sex receiving 10 to 100 ppm. Male rats fed 500, 1000, and 2000 ppm lead acetate had an increased renal tumor incidence of 5/50, 10/20, and 16/20, while 7/20 females in the 2000-ppm group developed renal tumors.

The Azar et al. (1973) study is limited by the lack of experimental detail. The possibility of environmental contamination from lead in the air or drinking water was not mentioned. The strains of rats used were not specified in the study, but the Health Effects Assessment for Lead (U.S. EPA, 1984) indicates the rats were Wistar strain. The weight gain at 1000 and 2000 ppm was reported to be depressed, but details were not given.

Kasprzak et al. (1985), in investigating the interaction of dietary calcium on lead carcinogenicity, fed 1% lead subacetate (8500 ppm Pb) to male Sprague-Dawley rats in the diet for 79 weeks. Of the rats surviving (29/30) in this treatment group beyond 58 weeks, 44.8% had renal tumors. Four rats had adenocarcinomas; the remainaing nine had adenomas. Bilateral tumors were noted. No renal tumors were noted among the controls.

As part of a study to determine interactions between sodium nitrite, ethyl urea and lead, male Sprague-Dawley rats were given lead acetate in their drinking water for 76 weeks (Koller et al., 1986). The concentration of lead was 2600 ppm. No kidney tumors were detected among the 10 control rats. Thirteen of 16 (81%) lead-treated rats had renal tubular carcinoma; three tumors were detected at 72 weeks and the remainder detected at the termination of the study.

Van Esch and Kroes (1969) fed basic lead acetate at 0, 0.1%, and 1.0% in the diet to 25 Swiss mice/sex/group for 2 years. No renal tumors developed in the control group, but 6/25 male mice of 0.1% basic lead acetate group had renal tumors (adenomas and carcinomas combined). In the 1.0% group, one female had a renal tumor. The authors thought that the low incidence in the 1.0% group was due to early mortality.

Hamsters given lead subacetate at 0.5% and 1% in the diet had no significant renal tumor response (Van Esch and Kroes, 1969).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Lead acetate induces cell transformation in Syrian hamster embryo cells (DiPaolo et al., 1978) and also enhances the incidence of simian adenovirus induction. Lead oxide showed similar enhanced adenovirus induction (Casto et al., 1979).

Under certain conditions lead compounds are capable of inducing chromosomal aberrations in vivo and in tissue cultures. Grandjean et al. (1983) showed a relationship between SCE and lead exposure in exposed workers. Lead has been shown, in a number of DNA structure and function assays, to affect the molecular processes associated with the regulation of gene expression (U.S. EPA, 1986).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

Quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1984. Health Effects Assessment for Lead. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-86/055. NTIS PB85-163996/AS.

U.S. EPA. 1986. Air Quality Criteria Document for Lead. Volumes III, IV.

Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC, for the Office of Air Quality Planning and Standards. EPA-600/8-83/028dF.

U.S. EPA. 1987. Preliminary review of the carcinogenic potential of lead associated with oral exposure. Prepared by the Office of Health and Environmental Assessment, Carcinogenic Assessment Group, Washington DC, for the Office of Drinking Water, Office of Solid Waste and the Office of Emergency and Remedial Response (Superfund). OHEA-C-267. Internal Review Draft.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The review of the carcinogenic potential of lead associated with oral exposure has received Agency review.

The 1986 Air Quality Criteria Document for Lead has received Agency and External Review.

Agency Work Group Review: 05/04/88

Verification Date: 05/04/88

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

William Pepelko / ORD -- (202)260-5898 / FTS 260-5898

James Cogliano / ORD -- (202)260-9243 / FTS 260-9243

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
At the end of each work shift.

** REMOVE CLOTHING:

Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (LEAD)
Not in excess of 0.5 mg/M3: Half-mask, air-purifying respirator equipped with high efficiency filters.
Not in excess of 2.5 mg/M3: Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 50 mg/M3: (1) Any powered, air-purifying respirator with high efficiency filters; or (2) Half-mask supplied-air respirator operated in positive-pressure mode.
Not in excess of 100 mg/M3: Supplied air respirator with full facepiece hood, or helmet or suit and operated in positive pressure mode.
Unknown concentration or Firefighting: Full facepiece, self-contained breathing apparatus operated in postive-pressure mode.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap flush promptly
INHALATION: art resp
INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ------------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: LEAD COMPOUNDS, SOLUBLE, N.O.S.
DOT ID NUMBER: UN2291

ERG93 GUIDE 53

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous if swallowed.
Inhalation of dust or mist may be poisonous.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water

pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
*SPILL OR LEAK
Do not touch or walk through spilled material; stop leak if you can do it without risk.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 116 LAST UPDATE OF THIS RECORD: 06/03/93

NAME:	CHROMIUM		
SYNONYMS:			
CAS:	7440-47-3	RTECS:	GB4200000
FORMULA:	Cr	MOL WT:	51.996
WLN:	CR		
CHEMICAL CLASS:	Metal		

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: steel-gray metal or silver metal powder.(nydh); blue-white to steel gray, lustrous, brittle, hard, odorless solid (niosh)

BOILING POINT:	2915 K	2641.8 C	4787.3 F
MELTING POINT:	2173 K	1899.8 C	3451.7 F
FLASH POINT:	Not applicable		
AUTO IGNITION:	Not applicable		
VAPOR PRESSURE:			
UEL:	Not applicable		
LEL:	Not applicable		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	No data		
DENSITY:	7.200		
WATER SOLUBILITY:			
INCOMPATIBILITIES:	strong oxidizers		

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	NONE Source:NYDH
100 % ODOR DETECTION:	No data

REGULATIONS

DOT hazard class:	9 CLASS 9
DOT guide:	31
Identification number:	UN3077
DOT shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CHROMIUM)

Packing group: III
Label(s) required: CLASS 9
Special provisions: 8, B54
Packaging exceptions: 173.155
Non bulk packaging: 173.213
Bulk packaging: 173.240
Quantity limitations-
Passenger air/rail: NONE
Cargo aircraft only: NONE
Vessel stowage: A
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
  Maximum Contaminant Levels (MCL): 0.1 mg/L (07/30/92)
  Maximum Contaminant Level Goals (MCLG): 0.1 mg/L (07/30/92)
CLEAN AIR ACT: CAA '90 By category
EPA WASTE NUMBER: D007
CERCLA REF: Y
RQ DESIGNATION: D 5000 pounds (2270 kg) CERCLA for pieces of solid metal with diameter less than 100 micrometers (0.004 inches).
SARA TPQ VALUE: Not listed
SARA Sect. 312
    categories:
Chronic toxicity: carcinogen
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:
   HEALTH HAZARD (BLUE): Unspecified
   FLAMMABILITY (RED) : Unspecified
   REACTIVITY (YELLOW): Unspecified
   SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/89/236665/AS)
CHROMIUM [7440-47-3]
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.

Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
National Toxicology Program (NTP) list of human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

---------------------------- TOXICITY DATA ----------------------------

SHORT TERM TOXICITY: INHALATION: dust may cause irritation of the nose, throat and lungs. SKIN: dust may cause irritation. Eyes: dust may cause irritation. INGESTION: dust may cause irritation of the mouth and throat.(NYDH)

LONG TERM TOXICITY: no information found on exposure to chromium metal. see specific chromium compounds.(NYDH)

TARGET ORGANS:

SYMPTOMS: HISTOLOGIC FIBROSIS OF LUNGS Source: NIOSHP

CONC IDLH: 250mg/m3(ASCr)

NIOSH REL:

ACGIH TLV: TLV = 0.5mg/M3 A4
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 1mg/M3
Final Rule Limits:
TWA = 1 mg/M3

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

REFERENCES:

ANIMAL SUSPECTED IARC** 2,100,73
ANIMAL INDEFINITE IARC** 23,205,80

CARCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not classifiable as a Human Carcinogen due to inadequate data.
OSHA: Not listed

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

unr-rat LD50:27500 ug/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

------------------------------ EPA's IRIS DATA SUMMARY ------------------------
Chromium(VI); CASRN 7440-47-3 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Chromium(VI)
CASRN -- 7440-47-3
Last Revised -- 03/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2

(Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- A; human carcinogen

Basis -- Results of occupational epidemiologic studies of chromium-exposed workers are consistent across investigators and study populations. Dose-response relationships have been established for chromium exposure and lung cancer. Chromium-exposed workers are exposed to both chromium III and chromium VI compounds. Because only chromium VI has been found to be carcinogenic in animal studies, however, it was concluded that only chromium VI should be classified as a human carcinogen.

___II.A.2. HUMAN CARCINOGENICITY DATA

Sufficient. Epidemiologic studies of chromate production facilities in the United States (Machle and Gregorius, 1948; Brinton et al., 1952; Mancuso and Hueper, 1951, Mancuso, 1975; Baetjer, 1950; Taylor, 1966; Enterline, 1974; Hayes et al., 1979; Hill and Ferguson, 1979), Great Britain (Bidstrup, 1951; Bidstrup and Case, 1956; Alderson et al., 1981), Japan (Watanabe and Fukuchi, 1975; Ohsaki et al., 1978; Sano and Mitohara, 1978; Satoh et al., 1981) and West Germany (Korallus et al., 1982; Bittersohl, 1971) have established an association between chromium (Cr) exposure and lung cancer. Most of these studies did not attempt to determine whether Cr III or Cr VI compounds were the etiologic agents.

Three studies of the chrome pigment industry, one in Norway (Langard and Norseth, 1975), one in England (Davies, 1978, 1979), and the third in the Netherlands and Germany (Frentzel-Beyme, 1983) also found an association between occupational chromium exposure (predominantly to Cr VI) and lung cancer.

Results of two studies of the chromium plating industry (Royle, 1975; Silverstein et al., 1981) were inconclusive, while the findings of a Japanese study of chrome platers were negative (Okubo and Tsuchiya, 1979). The results of studies of ferrochromium workers (Pokrovskaya and Shabynina, 1973; Langard et al., 1980; Axelsson et al., 1980) were inconclusive as to lung cancer risk.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Hexavalent chromium compounds were carcinogenic in animal assays producing the following tumor types: intramuscular injection site tumors in Fischer 344 and Bethesda Black rats and in C57BL mice (Furst et al., 1976; Maltoni, 1974, 1976; Payne, 1960; Heuper and Payne, 1959); intra-plural implant site tumors for various chromium VI compounds in Sprague-Dawley and Bethesda Black rats (Payne, 1960; Heuper 1961; Heuper and Payne, 1962); intrabronchial implantation site tumors for various Cr VI compounds in Wistar rats (Levy and Martin, 1983; Laskin et al., 1970; Levy as quoted in NIOSH, 1975); and subcutaneous injection site sarcomas in Sprague-Dawley rats (Maltoni, 1974, 1976).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

A large number of chromium compounds have been assayed in in vitro genetic toxicology assays. In general, hexavalent chromium is mutagenic in bacterial assays whereas trivalent chromium is not (Lofroth, 1978; Petrellie and Flora, 1977, 1978). Likewise Cr VI but not Cr III was mutagenic in yeasts (Bonatti et al., 1976) and in V79 cells (Newbold et al., 1979). Chromium III and VI compounds decrease the fidelity of DNA synthesis in vitro (Loeb et al., 1977), while Cr VI compounds inhibit replicative DNA synthesis in mammalian cells (Levis et al., 1978) and produce unscheduled DNA synthesis, presumably repair synthesis, as a consequence of DNA damage (Raffetto, 1977). Chromate has been shown to transform both primary cells and cell lines (Fradkin et al., 1975; Tsuda and Kato, 1977; Casto et al., 1979). Chromosomal effects produced by treatment with chromium compounds have been reported by a number of authors; for example, both Cr VI and Cr III salts were clastogenic for cultured human leukocytes (Nakamuro et al., 1978).

There are no long-term studies of ingested Cr VI. There appears to be significant in vivo conversion of Cr VI to Cr III and III to VI; Cr III is an essential trace element.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 1.2E-2 per (ug/cu.m)

Extrapolation Method -- Multistage, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	8E-3 ug/cu.m
E-5 (1 in 100,000)	8E-4 ug/cu.m
E-6 (1 in 1,000,000)	8E-5 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Species/Strain Tumor Type	Dose	Tumor Incidence		Reference
human	Route: Occupational exposure (inhalation)			
Age (years)	Midrange (ug/cu.m)	Deaths from Lung Cancer	Person Years	
50	5.66	3	1345	Mancuso, 1975
	25.27	6	931	
	46.83	6	299	
60	4.68	4	1063	
	20.79	5	712	
	39.08	5	211	
70	4.41	2	401	
	21.29	4	345	

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The cancer mortality in Mancuso (1975) was assumed to be due to Cr VI, which was further assumed to be no less than one-seventh of total chromium. It was also assumed that the smoking habits of chromate workers were similar to those of the U.S. white male population. The unit risks of Langard et al. (1980), Axelsson et al. (1980), and Pokrovskaya and Shabynina (1973) are 1.3E-1, 3.5E-2 and 9.2E-2 per (ug/cu.m), respectively.

Hexavalent chromium compounds have not produced lung tumors in animals by inhalation. Trivalent chromium compounds have not been reported as carcinogenic by any route of administration.

The unit risk should not be used if the air concentration exceeds 8E-1 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Results of studies of chromium exposure are consistent across investigators and countries. A dose-relationship for lung tumors has been established. The assumption that the ratio of Cr III to Cr VI is 6:1 may lead to a 7-fold underestimation of risk. The use of 1949 hygiene data, which may underestimate worker exposure, may result in an overestimation of risk. Further overestimation of risk may be due to the implicit assumption that the smoking habits of chromate workers were similar to those of the general white male population, since it is generally accepted that the proportion of smokers is higher for industrial workers than for the general population.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

Mancuso, T.F. 1975. International Conference on Heavy Metals in the Environment. Toronto, Ontario, Canada.

U.S. EPA. 1984. Health Assessment Document for Chromium. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH. EPA 600/8-83-014F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The quantification of cancer risk in the 1984 Health Assessment Document has received peer review in public sessions of the Environmental Health Committee of the U.S. EPA's Science Advisory Board.

Agency Work Group Review: 06/26/86

Verification Date: 06/26/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Herman J. Gibb / ORD -- (202)260-5898 / FTS 260-5898

Chao W. Chen / ORD -- (202)260-5719 / FTS 260-5719

-------------------------- PROTECTION AND FIRST AID --------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes contaminated.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (CHROMIUM)
2.5 mg/M3: Any dust and mist respirator except single-use respirators. * Substance reported to cause eye irritation or damage may require eye protection.
5 mg/M3: Any dust and mist respirator except single-use and quarter-mask respirators. * Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection.
12.5 mg/M3: Any powered air-purifying respirator with a dust and mist filter. * Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require eye protection.
25 mg/M3: Any air-purifying full facepiece respirator with a high-efficiency particulate filter. / Any powered air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
250 mg/M3: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator with a high-efficiency particulate filter. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash
INHALATION: art resp
INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ------------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CHROMIU
DOT ID NUMBER: UN3077

ERG93 GUIDE 31

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Material may be transported hot.
*HEALTH HAZARDS
Contact may cause burns to skin and eyes.
Inhalation of asbestos dust may have a damaging effect on the lungs.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.
Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
*Do not scatter spilled material with high-pressure water streams.
Dike fire control water for later disposal.
*SPILL OR LEAK
Stop leak if you can do it without risk.
Avoid inhalation of asbestos dust.
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
Cover powder spill with plastic sheet or tarp to minimize spreading.
*FIRST AID

In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 84 LAST UPDATE OF THIS RECORD: 06/03/93

NAME:	CADMIUM		
SYNONYMS:	NONE		
CAS:	7440-43-9	RTECS:	EU9800000
FORMULA:	Cd	MOL WT:	112.40
WLN:	.CD		
CHEMICAL CLASS:	Metal		

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: soft, blue-white, malleable, lustrous metal; grayish-white powder

BOILING POINT:	1040 K	766.8 C	1412.3 F
MELTING POINT:	593.9 K	320.7 C	609.3 F
FLASH POINT:		Not applicable	
AUTO IGNITION:		Not applicable	
VAPOR PRESSURE:			
UEL:	Not applicable		
LEL:	Not applicable		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	8.64		
DENSITY:	8.64		
WATER SOLUBILITY:	insoluble		
INCOMPATIBILITIES:	strong ox,elemental sulfur,selenium,tellurium		

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	oxides of cadmium
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	No data
100 % ODOR DETECTION:	No data

REGULATIONS

DOT hazard class:	9 CLASS 9
DOT guide:	31
Identification number:	UN3077
DOT shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CADMIUM)
Packing group:	III

Label(s) required: CLASS 9
Special provisions: 8, B54
Packaging exceptions: 173.155
Non bulk packaging: 173.213
Bulk packaging: 173.240
Quantity limitations-
Passenger air/rail: NONE
Cargo aircraft only: NONE
Vessel stowage: A
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.005 mg/L (07/30/92)
Maximum Contaminant Level Goals (MCLG): 0.005 mg/L (07/30/92)
CLEAN AIR ACT: CAA '90 By category
EPA WASTE NUMBER: D006
CERCLA REF: Y
RQ DESIGNATION: A 10 pounds (4.54 kg) CERCLA for pieces of solid met with diameter less than 100 micrometers (0.004 inches).
SARA TPQ VALUE: Not listed
SARA Sect. 312 categories:
Acute toxicity: adverse effect to target organs.
Chronic toxicity: carcinogen
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.
Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:
HEALTH HAZARD (BLUE): Unspecified
FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS**
CADMIUM [7440-43-9]
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
EPA Carcinogen Assessment Group List
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
National Toxicology Program list of anticipated human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Suspected carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

------------------------------ TOXICITY DATA ------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS: resp sys,lungs,kidneys,prostate,blood

SYMPTOMS: PULM EDEMA, CYPS, COUGH, TIGHT CHEST, SUBS PAIN; HEAD, CHILLS, MUSCLE ACHE; NAU, DIAR ANOSMIA, EMPHY; PROTEINURIA, ANEMIA Source: NIOSHP

CONC IDLH: 9mg/M3(asCd)

NIOSH REL: Potential occupational carcinogen --LOWEST FEASIBLE (LOQ 0.01 mg/M3)

ACGIH TLV: TLV = RESPIRABLE FRACTION 0.002mg/M3 as CADMIUM--TOTAL DUST 0.01 Mg/M3 Suspected human carcinogen (A2)

ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:
TWA = 5 ug/M3
Consult 29CFR 1910.1027

MAK INFORMATION: Carcinogenic working material without MAK
In the Commission's view, an animal carcinogen.

CARCINOGEN?: Y STATUS: See below

REFERENCES:

ANIMAL POSITIVE IARC** 2,74,73
ANIMAL POSITIVE IARC** 11,39,76

CARCINOGEN LISTS:

IARC: Carcinogen as defined by IARC as carcinogenic to humans, with sufficient epidemiological evidence.
MAK: An animal carcinogen.
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.
ACGIH: Carcinogen defined by ACGIH TLV Committee as a suspected carcinogen, based on either limited epidemological evidence or demonstration of carcinogenicity in experimental animals.
OSHA: Cancer hazard

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-man TCLo:88 ug/m3/8.6Y AEHLAU 28,147,74
KIDNEY,URETER,BLADDER
Proteinuria

ihl-hmn LCLo:39 mg/m3/20M AIHAAP 31,180,70
CARDIAC
Other changes
VASCULAR
Thrombosis distant from injection site(except brain,heart)
LUNGS, THORAX, OR RESPIRATION
Respiratory depression

LD50 value: orl-rat LD50:225 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:225 mg/kg
ihl-rat LC50:25 mg/m3/30M

ipr-rat LD50:4 mg/kg
scu-rat LD50:9 mg/kg
ivn-rat LD50:1800 ug/kg
unr-rat LD50:1140 mg/kg
orl-mus LD50:890 mg/kg
ihl-mus LCLo:170 mg/m3
ipr-mus LD50:5700 ug/kg
unr-mus LD50:890 mg/kg
orl-rbt LDLo:70 mg/kg
scu-rbt LDLo:6 mg/kg
ivn-rbt LDLo:5 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:155 mg/kg (13W male/13W pre-3W preg) BECTA6 20,96,78
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)
EFFECTS ON NEWBORN
Behavioral

orl-rat TDLo:220 mg/kg (1-22D preg) TOLED5 11,233,82
EFFECTS ON EMBRYO OR FETUS
Other effects on embryo or fetus

orl-rat TDLo:21500 ug/kg (multigenerations) ENVRAL 22,466,80
EFFECTS ON FERTILITY
Pre-implantation mortility
EFFECTS ON NEWBORN
Germ cell effects(in offspring)

orl-rat TDLo:23 mg/kg (1-22D preg) PSEBAA 158,614,78
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Blood and lymphatic systems(including spleen and marrow)

ipr-rat TDLo:1124 ug/kg (1D male) TXAPA9 41,194,77
PATERNAL EFFECTS
Spermatogenisis

scu-rat TDLo:250 ug/kg (19D preg) APTOD9 19,A122,80
EFFECTS ON NEWBORN

ivn-rat TDLo:1250 ug/kg (14D preg) JJATDK 1,264,81
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Body wall

SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

ivn-rat TDLo:1250 ug/kg (9D preg) JJATDK 1,264,81
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Central nervous system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Eye,ear

ivn-rat TDLo:8 mg/kg (8-15D preg) JJATDK 1,264,81
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

orl-mus TDLo:448 mg/kg (multigenerations) AEHLAU 23,102,71
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-mus TDLo:1700 mg/kg (8-12D preg) TCMUD8 6,361,86
EFFECTS ON NEWBORN
Viability index(# alive at day 4 per # born alive)
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

ipr-mus TDLo:1686 ug/kg (7D preg) TJADAB 28,39A,83
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Central nervous system

California Prop 65: No significant risk level .05 ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Cadmium; CASRN 7440-43-9 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Cadmium
CASRN -- 7440-43-9
Last Revised -- 03/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2

(Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B1; probable human carcinogen

Basis -- Limited evidence from occupational epidemiologic studies of cadmium is consistent across investigators and study populations. There is sufficient evidence of carcinogenicity in rats and mice by inhalation and intramuscular and subcutaneous injection. Seven studies in rats and mice wherein cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of carcinogenic response.

___II.A.2. HUMAN CARCINOGENICITY DATA

Limited. A 2-fold excess risk of lung cancer was observed in cadmium smelter workers. The cohort consisted of 602 white males who had been employed in production work a minimum of 6 months during the years 1940-1969. The population was followed to the end of 1978. Urine cadmium data available for 261 workers employed after 1960 suggested a highly exposed population. The authors were able to ascertain that the increased lung cancer risk was probably not due to the presence of arsenic or to smoking (Thun et al., 1985). An evaluation by the Carcinogen Assessment Group of these possible confounding factors has indicated that the assumptions and methods used in accounting for them may not be valid. As the SMRs observed were low and there is a lack of clear cut evidence of a causal relationship of the cadmium exposure only, this study is considered to supply only limited evidence of human carcinogenicity.

An excess lung cancer risk was also observed in three other studies which were, however, compromised by the presence of other carcinogens (arsenic, smoking) in the exposure or by a small population (Varner, 1983; Sorahan and Waterhouse, 1983; Armstrong and Kazantzis, 1983).

Four studies of workers exposed to cadmium dust or fumes provided evidence of a statistically significant positive association with prostate cancer (Kipling and Waterhouse, 1967; Lemen et al., 1976; Holden, 1980; Sorahan and Waterhouse, 1983), but the total number of cases was small in each study. The Thun et al. (1985) study is an update of an earlier study (Lemen et al., 1976) and does not show excess prostate cancer risk in these workers. Studies of human ingestion of cadmium are inadequate to assess carcinogenicity.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Exposure of Wistar rats to cadmium as cadmium chloride at concentrations of 12.5, 25 and 50 ug/cu.m for 18 months, with an additional 13-month observation period, resulted in significant increases in lung tumors (Takenaka et al., 1983). Intratracheal instillation of cadmium oxide did not produce lung tumors in Fischer 344 rats but rather mammary tumors in females and tumors at multiple sites in males (Sanders and Mahaffey, 1984). Injection site tumors and distant site tumors (for example, testicular) have been reported by a number of authors as a consequence of intramuscular or subcutaneous administration of cadmium metal and chloride, sulfate, oxide and sulfide compounds of cadmium to rats and mice (U.S. EPA, 1985). Seven studies in rats and mice where cadmium salts (acetate, sulfate, chloride) were administered orally have shown no evidence of a carcinogenic response.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Results of mutagenicity tests in bacteria and yeast have been inconclusive. Positive responses have been obtained in mutation assays in Chinese hamster cells (Dom and V79 lines) and in mouse lymphoma cells (Casto, 1976; Ochi and Ohsawa, 1983; Oberly et al., 1982).

Conflicting results have been obtained in assays of chromosomal aberrations in human lymphocytes treated in vitro or obtained from exposed workers. Cadmium treatment in vivo or in vitro appears to interfere with spindle formation and to result in aneuploidy in germ cells of mice and hamsters (Shimada et al., 1976; Watanabe et al., 1979; Gilliavod and Leonard, 1975).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available. There are no positive studies of orally ingested cadmium suitable for quantitation.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 1.8E-3 per (ug/cu.m)

Extrapolation Method -- Two stage; only first affected by exposure; extra risk

Air Concentrations at Specified Risk Levels:

Risk Level   Concentration

E-4 (1 in 10,000)	6E-2 ug/cu.m
E-5 (1 in 100,000)	6E-3 ug/cu.m
E-6 (1 in 1,000,000)	6E-4 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- lung, trachea, bronchus cancer deaths
Test Animals -- human/white male
Route -- inhalation, exposure in the workplace
Reference -- Thun et al., 1985

Cumulative Exposure (mg/day/cu.m)	Median Observation	24 hour/ ug/cu.m Equivalent	No. of Expected Lung, Trachea and Bronchus Cancers Assuming No Cadmium Effect	Observed No. of Deaths (lung, trachea, bronchus cancers)
less than or equal to 584	280	168	3.77	2
585-2920	1210	727	4.61	7
greater than or equal to 2921	4200	2522	2.50	7

The 24-hour equivalent = median observation x 10E-3 x 8/24 x 1/365 x 240/365.

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if the air concentration exceeds 6 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

The data were derived from a relatively large cohort. Effects of arsenic and smoking were accounted for in the quantitative analysis for cadmium effects.

An inhalation unit risk for cadmium based on the Takenaka et al. (1983) analysis is 9.2E-2 per (ug/cu.m). While this estimate is higher than that derived from human data [1.8E-3 per (ug/cu.m)] and thus more conservative, it was felt that the use of available human data was more reliable because of species variations in response and the type of exposure (cadmium salt vs.

cadmium fume and cadmium oxide).

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Updated Mutagenicity and Carcinogenicity Assessment of Cadmium: Addendum to the Health Assessment Document for Cadmium (May 1981, EPA 600/B-Bl-023). EPA 600/B-83-025F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Cadmium Health Assessment has received both Agency and external review.

Agency Work Group Review: 11/12/86

Verification Date: 11/12/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

William E. Pepelko / ORD -- (202)260-5904 / FTS 260-5904

David Bayliss / ORD -- (202)260-5726 / FTS 260-5726

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR EYE PROTECTION TO PREVENT:

** EXPOSED PERSONNEL SHOULD WASH:
At the end of each work shift when there was a reasonable probability of co

** WORK CLOTHING SHOULD BE CHANGED DAILY:
If there is any possibility that the clothing may be contaminated.

** THE FOLLOWING EQUIPMENT SHOULD BE MADE AVAILABLE:
Eyewash.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (CADMIUM)
50 ug/M3 or less: Half mask, air purifying respirator equipped with a HEPA filter.
125 ug/M3 or less: A powered air purifying respirator (PAPR) with a loose-fitting hood or helmet equipped with a HEPA filter, or a supplied air respirator with a loose-fitting hood or helmet facepiece operated in the continuous flow mode.
250 ug/M3 or less: A full facepiece air-purifying respirator equipped with a HEPA filter, or a powered air-purifying respiratorwith a tight-fitting half-mask equipped with a HEPA filter, or a supplied-air respirator with a tight-fitting half mask operated in the continuous flow mode.
1250 ug/M3 or less: A powered air-purifying respirator with a tight fitting full facepiece equipped with a HEPA filter, or a supplied air respirator with a tight-fitting full facepiece operated in the continuous flow mode.
5000 ug/M3 or less: A supplied air respirator with half-mask or full facepiece operated in the pressure demand or other positive pressure mode.
Greater than 5000 ug/M3 or unknown concentration: A self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode, or a supplied-air respirator with a full facepiece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.:
Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash
INHALATION: art resp
INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE -----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (CADMIUM
DOT ID NUMBER: UN3077

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Material may be transported hot.

*HEALTH HAZARDS
Contact may cause burns to skin and eyes.
Inhalation of asbestos dust may have a damaging effect on the lungs.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.
Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
*Do not scatter spilled material with high-pressure water streams.
Dike fire control water for later disposal.

*SPILL OR LEAK
Stop leak if you can do it without risk.
Avoid inhalation of asbestos dust.
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
Cover powder spill with plastic sheet or tarp to minimize spreading.

*FIRST AID
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 49 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	ARSENIC		
SYNONYMS:	ARSENICALS; ARSEN (German, Polish); ARSENIC BLACK; ARSENIC-75; ARSENIC, SOLID; COLLOIDAL ARSENIC; GREY ARSENIC; METALLIC ARSENIC		
CAS:	7440-38-2	RTECS:	CG0525000
FORMULA:	As4	MOL WT:	299.69
WLN:	AS4		
CHEMICAL CLASS:	Metal		

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION:	silvery to black, brittle; grey, shiny, metallic looking; crystalline and amorphous metalloid		
BOILING POINT:	SUBLIMES		SUBLIMES
MELTING POINT:	885.9 K	612.7 C	1134.9 F
FLASH POINT:	Not applicable		
AUTO IGNITION:	Not applicable		
VAPOR PRESSURE:	1mm @ 372 C		
UEL:	Not applicable		
LEL:	Not applicable		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	5.73 (METAL)		
DENSITY:	5.724 g/mL		
WATER SOLUBILITY:	INSOL		
INCOMPATIBILITIES:	oxidizers, acids; bromine oxide, dirubidium acetylide, halogens, palladium, zinc, platinum, nitrogen trichloride, silver nitrate, chromium trioxide, sodium peroxide		

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	CAN REACT VIGOROUSLY ON CONTACT WITH OXIDIZING MATERIALS. MODERATE FIRE HAZARD, IN THE FORM OF DUST WHEN EXPOSED TO HEAT OR FLAME OR BY CHEMICAL REACTION WITH POWERFUL OXIDIZERS SUCH AS BROMATES, CHLORATES, IODATES, PEROXIDES, LITHIUM, NITROGEN TRICHLORIDE
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	WHEN HEATED OR ON CONTACT WITH ACID OR ACID FUMES, EMITS HIGHLY TOXIC FUMES

ODOR DETECTED AT (ppm): Unknown
ODOR DESCRIPTION: GARLIC Source:Unspecified
100 % ODOR DETECTION: No data

------------------------------- REGULATIONS ---------------------------------

DOT hazard class: 6.1 POISON
DOT guide: 53
Identification number: UN1558
DOT shipping name: Arsenic
Packing group: II
Label(s) required: POISON
Special provisions:
Packaging exceptions: 173.None
Non bulk packaging: 173.212
Bulk packaging: 173.242
Quantity limitations-
Passenger air/rail: 25 kg
Cargo aircraft only: 100 kg
Vessel stowage: A
Other stowage provisions:

STCC NUMBER: 4923207

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.05 mg/L (12/24/75)
Maximum Contaminant Level Goals (MCLG): Not specified
CLEAN AIR ACT: CAA '90 By category
EPA WASTE NUMBER: D004
CERCLA REF: Y
RQ DESIGNATION: X 1 pound (0.454 kg) CERCLA for pieces of solid metal with diameter less than 100 micrometers (0.004 inches).
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Chronic toxicity: carcinogen
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Poison, Class B - Mailable as ORM-D
Mailability: Domestic service and air transportation shipper's declaration required
Max per parcel: 8 OZ

NFPA CODES:

HEALTH HAZARD (BLUE): Unspecified
FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ARSENIC [7440-38-2]
ATSDR Toxicology Profile available (NTIS** PB/89/185706/AS)
California OSHA Carcinogens List.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Carcinogenic pesticide nominated for inclusion on California Proposition 65 List
Clean Air Act Section 112 Hazardous Air Pollutants List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Known carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"
Massachusetts Substance List.
National Toxicology Program (NTP) list of human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

------------------------------ TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: COUGHING, DYSPNEA, CHEST PAINS, IRRITATION TO SKIN AND MUCOUS MEMBRANES, FEVER, INSOMNIA, ANOREXIA, LIVER SWELLING, MELANOSIS, DISTURBED HEART FUNCTION AND FACIAL EDEMA. ** Source: 15

LONG TERM TOXICITY: unknown

TARGET ORGANS:

SYMPTOMS: NAUSEA, VOMITING, DIARRHEA, DEATH Source:

CONC IDLH: 5mg/m3 (ASAs)

NIOSH REL: Potential occupational carcinogen 0.002 mg/M3
Ceiling exposures which shall at no time be exceeded

ACGIH TLV: TLV = 0.01mg/M3 as ARSENIC Confirmed human carcinogen (A1)

ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:
TWA = 0.01 mg/M3
CONSULT 29CFR 1910.1018

MAK INFORMATION: Not listed

CARCINOGEN?: Y STATUS: See below

REFERENCES:

HUMAN POSITIVE IARC** 23,39,80
INDEFINITE IARC** 2,48,73

CARCINOGEN LISTS:

IARC: Carcinogen as defined by IARC as carcinogenic to humans, with sufficient epidemiological evidence.
MAK: Not listed
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Carcinogen defined by NTP as known to be carcinogenic, with evidence from human studies.
ACGIH: Carcinogen defined by ACGIH TLV Committee as a confirmed human carcinogen, recognized to have carcinogenic or cocarcinogenic potential.
OSHA: Cancer hazard

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-man TDLo:7857 mg/kg/55Y CMAJAX 120,168,79
GASTROINTESTINAL
Changes on structute or function of esophagus
BLOOD
Hemorrhage
SKIN AND APPENDAGES
Skin - after systemic exposure
Dermatitis,other

LD50 value: orl-rat LD50:763 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:763 mg/kg
ipr-rat LD50:13390 ug/kg
orl-mus LD50:145 mg/kg
ipr-mus LD50:46200 ug/kg
scu-rbt LDLo:300 mg/kg
ipr-gpg LDLo:10 mg/kg
scu-gpg LDLo:300 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:605 ug/kg (35W pre) GISAAA 42(8),30,77
EFFECTS ON FERTILITY
Pre-implantation mortility
EFFECTS ON FERTILITY
Post-implantation mortality

California Prop 65: No significant risk level-inhalation .06 ugD (01/01/94)
No significant risk level-except inhalation 10. ugD (01/01/94)
Carcinogen (02/27/87)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Arsenic, inorganic; CASRN 7440-38-2 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Arsenic, inorganic
CASRN -- 7440-38-2
Last Revised -- 02/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- A; human carcinogen

Basis -- based on observation of increased lung cancer mortality in populations exposed primarily through inhalation and on increased skin cancer incidence in several populations consuming drinking water with high arsenic concentrations.

___II.A.2. HUMAN CARCINOGENICITY DATA

Studies of smelter worker populations (Tacoma, WA; Magma, UT; Anaconda, MT; Ronnskar, Sweden; Saganoseki-Machii, Japan) have all found an association between occupational arsenic exposure and lung cancer mortality (Enterline and Marsh, 1982; Lee-Feldstein, 1983; Axelson et al., 1978; Tokudome and Kuratsune, 1976; Rencher et al., 1977). Both proportionate mortality and cohort studies of pesticide manufacturing workers have shown an excess of lung cancer deaths among exposed persons (Ott et al., 1974; Mabuchi et al., 1979). One study of a population residing near a pesticide manufacturing plant revealed that these residents were also at an excess risk of lung cancer (Matanoski et al., 1981). Case reports of arsenical pesticide applicators have also demonstrated an association between arsenic exposure and lung cancer (Roth, 1958).

A cross-sectional study of 40,000 Taiwanese exposed to arsenic in drinking water found significant excess skin cancer prevalence by comparison to 7500 residents of Taiwan and Matsu who consumed relatively arsenic-free water (Tseng et al., 1968). This study design limited its usefulness in risk estimation. Arsenic-induced skin cancer has also been attributed to water supplies in Chile, Argentina and Mexico (Borgono and Greiber, 1972; Bergoglio, 1964; Cebrian et al., 1983). No excess skin cancer incidence has been observed in U.S. residents consuming relatively high levels of arsenic in drinking water (Morton et al., 1976; Southwick et al., 1981). The results of these U.S. studies, however, are not necessarily inconsistent with the existing findings from the foreign populations. The statistical powers of the U.S. studies are considered to be inadequate because of the small sample size.

A follow-up study (Tseng, 1977) of the population living in the same area of Taiwan, where arsenic contamination of the water supply was endemic, found significantly elevated standard mortality ratios for cancer of the bladder, lung, liver, kidney, skin and colon. This study of bladder, liver and lung cancer cases in the endemic area found a significant association with arsenic exposure that was dose-related. The association of arsenic ingestion and cancer of various internal organs has also been cited in a number of case reports (Chen et al., 1985, 1986). Persons treated with arsenic-containing medicinals have also been shown to be at a risk of skin cancer (Sommers and McManus, 1953).

___II.A.3. ANIMAL CARCINOGENICITY DATA

None. There has not been consistent demonstration of arsenic carcinogenicity in test animals for various chemical forms administered by different routes to several species (IARC, 1980). There are some data to indicate that arsenic may produce animal tumors if retention time in the lung can be increased (Pershagen et al., 1982, 1984).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Sodium arsenate has been shown to transform Syrian hamster embryo cells (Dipaolo and Casto, 1979) and to produce sister-chromatid-exchange in DON cells, CHO cells and human peripheral lymphocytes exposed in vitro (Wan et al., 1982; Ohno et al., 1982; Larramendy et al., 1981; Andersen, 1983; Crossen, 1983). While arsenic compounds have not been shown to mutate bacterial strains, it produces preferential killing of repair deficient strains (Rossman, 1981).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

The Risk Assessment Forum has completed a reassessment of the carcinogenicity risk associated with ingestion of inorganic arsenic. This report, which has been extensively peer-reviewed by outside reviewers (including SAB review) concluded that the most appropriate basis for an oral quantitative estimate was the study by Tseng et al. (1977), which reported increased prevalence of skin cancers in humans as a consequence of arsenic exposure in drinking water. Based on this study a unit risk of 5E-5/ug/L was proposed.

A recent memorandum by the Administrator of the EPA recommended that the above unit risk be adopted. The memorandum further counsels that "in reaching risk management decisions in a specific situation, risk managers must recognize and consider the qualities and uncertainties of risk estimates. The uncertainties associated with ingested inorganic arsenic are such that estimates could be modified downwards as much as an order of magnitude, relative to risk estimates associated with most other carcinogens. In such instances, the management document must clearly articulate this fact and state the factors that influenced such a decision."

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 4.3E-3/ug/cu.m

Extrapolation Method -- absolute-risk linear model

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E-2 ug/cu.m
E-5 (1 in 100,000)	2E-3 ug/cu.m
E-6 (1 in 1,000,000)	2E-4 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- lung cancer
Test Animals -- human, male
Route -- inhalation, occupational exposure
Reference -- Brown and Chu, 1983a,b,c; Lee-Feldstein, 1983; Higgins, 1982; Enterline and Marsh, 1982

Ambient Unit Risk Estimates

Exposure Source	Study	Unit Risk	Geometric Mean Unit Risk	Final Estimates Unit Risk
Anaconda smelter	Brown and Chu, 1983a,b,c	1.25 E-3		
	Lee-Feldstein, 1983	2.80 E-3	2.56 E-3	
	Higgins, 1982; Higgins et al., 1982; Welch et al., 1982	4.90 E-3		4.29 E-3
ASARCO smelter	Enterline and Marsh, 1982	6.81 E-3	7.19 E-3	
		7.60 E-3		

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

A geometric mean was obtained for data sets obtained within distinct exposed populations (U.S. EPA, 1984). The final estimate is the geometric mean of those two values. It was assumed that the increase in age-specific mortality rate of lung cancer was a function only of cumulative exposures.

The unit risk should not be used if the air concentration exceeds 2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Overall a large study population was observed. Exposure assessments included air measurements for the Anaconda smelter and both air measurements and urinary arsenic for the ASARCO smelter. Observed lung cancer incidence was significantly increased over expected values. The range of the estimates derived from data from two different exposure areas was within a factor of 6.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1984. Health Assessment Document for Inorganic Arsenic. Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-83-021F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1984 Health Assessment Document for Inorganic Arsenic received Agency and external review including a review by SAB.

Agency Work Group Review: 01/13/88

Verification Date: 01/13/88

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Herman J. Gibb / ORD -- (202)260-5898 / FTS 260-5898

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (ARSENIC)
Unknown concentration or Greater than 20000 ug/M3 (20 mg/M3) or
Firefighting: Any full facepiece self-contained breathing apparatus
operated in positive pressure mode.

Not greater than 20000 ug/M3 (20 mg/M3): Supplied air respirator with full facepiece hood, or helmet or suit and operated in positive pressure mode.
Not greater than 10000 ug/M3 (10 mg/M3): (A) Powered air-purifying respirators in all inlet face coverings with high efficiency filters.1 (B) Half-mask supplied air respirators operated in positive pressure mode.
Not greater than 500 ug/M3: (A) Full facepiece air-purifying respirator equipped with high-efficiency filter.1 (B) Any full facepiece supplied air respirator. (C) Any full facepiece self-contained breathing apparatus.
Not greater than 100 ug/M3: (A) Half-mask air-purifying respirator equipped with high-efficiency filter.1 (B) Any half-mask supplied air respirator.

FIRST AID SOURCE: THIC
EYE: irrigate eyes with water.
SKIN: wash contaminated areas of body with soap and water.
INHALATION: None given
INGESTION: None given

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Arsenic
DOT ID NUMBER: UN1558

ERG93 GUIDE 53

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous if swallowed.
Inhalation of dust or mist may be poisonous.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
*SPILL OR LEAK
Do not touch or walk through spilled material; stop leak if you can do it without risk.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------ IDENTIFIERS ------------------------------

CHEMTOX RECORD 146 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: DDT

SYNONYMS: AGRITAN; ANOFEX; ARKOTINE; AZOTOX; BENZENE, 1,1'-(2,2,2-TRICHLOROETHYLIDENE)BIS(4-CHLORO-; alpha,alpha-BIS(p-CHLOROPHENYL)-beta,beta,beta-TRICHLORETHANE; 1,1-BIS-(p-CHLOROPHENYL)-2,2,2-TRICHLOROETHANE; 2,2-BIS(p-CHLOROPHENYL)-1,1,1-TRICHLOROETHANE; BOSAN SUPRA; BOVIDERMOL; CHLOROPHENOTHAN; CHLOROPHENOTHANE; CHLOROPHENOTOXUM; CITOX; CLOFENOTANE; DDT; p,p'-DDT; DDT (DOT); DEDELO; DEOVAL; DETOX; DETOXAN; DIBOVAN; DICHLORODIPHENYLTRICHLOROETHANE; p,p'-DICHLORODIPHENYLTRICHLOROETHANE; 4,4'-DICHLORODIPHENYLTRICHLOROETHANE; DICHLORODIPHENYLTRICHLOROETHANE (DOT); DICOPHANE; DIDIGAM; DIDIMAC; DIPHENYLTRICHLOROETHANE; DODAT; DYKOL; ENT 1,506; ESTONATE; GENITOX; GESAFID; GESAPON; GESAREX; GESAROL; GUESAROL; GYRON; HAVERO-EXTRA; IVORAN; IXODEX; KOPSOL; MUTOXIN; NCI-C00464; NEOCID; PARACHLOROCIDUM; PEB1; PENTACHLORIN; PENTECH; PPZEIDAN; RUKSEAM; SANTOBANE; 1,1,1-TRICHLOOR-2,2-BIS(4-CHLOOR FENYL)-ETHAAN (Dutch); 1,1,1-TRICHLOR-2,2-BIS(4-CHLOR-PHENYL)-AETHAN (German); TRICHLOROBIS(4-CHLOROPHENYL)ETHANE; 1,1,1-TRICHLORO-2,2-BIS(p-CHLOROPHENYL)ETHANE; 1,1,1-TRICHLORO-2,2-DI(4-CHLOROPHENYL)-ETHANE; 1,1,1-TRICLORO-2,2-BIS(4-CLORO-FENIL)-ETANO (Italian); ZEIDANE; ZERDANE; 2,2-BIS(P-CHLOROPHENYL)-1,1-TRICHLOROETHANE; 4,4' DDT; DICHLORODIPHENYL TRICHLOROETHANE; DICHLORO DIPHENYL TRICHLOROETHANE; 1,1,1-TRICHLORO-2,2-BIS(P-CHLOROPHENYL)ETHANE; 1,1-BIS(P-CHLOROPHENYL)-2,2,2-TRICHLOROETHANE

CAS: 50-29-3 RTECS: KJ3325000

FORMULA: C14H9Cl5 MOL WT: 354.48

WLN: GXGGYR DG

CHEMICAL CLASS: Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ------------------------------

PHYSICAL DESCRIPTION: pure ddt is a colorless, white or slightly off-white powder. technical grade ddt is a white or cream colored waxy solid. available as powders, granules, aerosols, smoke candles, emulsifiable concentrates and vaporizer charges. may be dissolved in a hydrocarbon (nydh)

BOILING POINT: 383.15 K dec 110 C dec 230 F dec

MELTING POINT:	382.04 K	108.8 C	228 F
FLASH POINT:	345.37-350.4 K	72.22-77.25 C	161.9-171 F

AUTO IGNITION: Not available
VAPOR PRESSURE: LOW
UEL: Not applicable
LEL: Not applicable
VAPOR DENSITY: No data
SPECIFIC GRAVITY: 0.99 @ 20C
DENSITY: 0.99 g/cc or 9.207 lb/gal
WATER SOLUBILITY: 0.00001%
INCOMPATIBILITIES: strong ox

REACTIVITY WITH WATER: No data on water reactivity
REACTIVITY WITH COMMON MATERIALS: No data
STABILITY DURING TRANSPORT: No Data
NEUTRALIZING AGENTS: No data
POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: None reported other than possible unburned vapors
ODOR DETECTED AT (ppm): Not pertinent
ODOR DESCRIPTION: None Source:CHRIS
100 % ODOR DETECTION: No data

------------------------------- REGULATIONS ----------------------------------

DOT hazard class: 6.1 POISON
DOT guide: 55
Identification number: UN2761
DOT shipping name: ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
Packing group: II
Label(s) required: POISON
Special provisions:
Packaging exceptions: 173.NONE
Non bulk packaging: 173.212
Bulk packaging: 173.242
Quantity limitations-
Passenger air/rail: 25 KG
Cargo aircraft only: 100 KG
Vessel stowage: A
Other stowage provisions:40

STCC NUMBER: 4941129

CLEAN WATER ACT Sect.307:No
CLEAN WATER ACT Sect.311:Yes
CLEAN AIR ACT: Not listed
EPA WASTE NUMBER: U061
CERCLA REF: Y
RQ DESIGNATION: X 1 pound (0.454 kg) CERCLA
SARA TPQ VALUE: Not listed

SARA Sect. 312
categories:

Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
Acute toxicity: adverse effect to target organs.
Chronic toxicity: carcinogen
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	ORM-A
Mailability:	Domestic service and air transportation; shipper's declaration required
Max per parcel:	70 LBS; 5 LBS

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

ATSDR Toxicology Profile available (NTIS** PB/90/182171/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
Canadian Domestic Substances List
Clean Water Act Section 311 Hazardous Chemicals List.
DDT [50-29-3]
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA Office of Pesticide Programs. List of active ingredients, 24 April, 1989.
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
First Third Wastes List. 40 CFR 268.10. 54 FR 26594 (June 23, 1989)
Massachusetts Substance List.
National Toxicology Program list of anticipated human carcinogens
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: 500-4200 mg/m3 has produced dizziness. SKIN: can cause irritation in very high concentrations. ddt can be absorbed through the skin if dissolved in vegetable oils or other solvents. Eyes: can cause irritation. INGESTION: 1/30 - 1/4 ounce has caused nausea, vomiting, headache and convulsions. other symptoms include weakness, restlessness, dizziness, incoordination, numbness of face and extremities, abdominal pain, diarrhea, tremors, and death. symptoms may be delayed from 1/2 - 3 hours. estimated lethal dose is between 1 teaspoon and 1 ounce.(NYDH)

LONG TERM TOXICITY: contact with dust can cause skin and eye irritation. occupational exposure to ddt has been associated with changes in genetic material. ddt levels build up and remain in the body for long periods of time. ddt causes cancer in mice. whether it causes cancer in humans is unknown.(NYDH)

TARGET ORGANS: CNS,kidneys,liver,skin,pns, gi tract, lungs

SYMPTOMS: Very large doses are followed promptly by vomiting, due to local gastric irritation; delayed emesis or diarrhea may occur. With smaller doses, symptoms usually appear 2-3 hours after ingestion. These include tingling of lips, tongue, and face; malaise, headache, sore throat, fatigue, coarse tremors of neck, head, and eyelids; apprehension, ataxia, and confusion. Convulsions may alternate with periods of coma and partial paralysis. Vital signs are essentially normal, but in severe poisoning the pulse may be irregular and abnormally slow; ventricular fibrillation and sudden death may occur at any time during acute phase. Pulmonary edema usually indicates solvent intoxication. Source: CHRIS

CONC IDLH: 500mg/m3

NIOSH REL: Potential occupational carcinogen 0.5 mg/M3 Time weighted averages for 8-hour exposure (LOQ 0.1 mg/M3)

ACGIH TLV: TLV = 1mg/M3
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 1mg/M3(SKIN)
Final Rule Limits:
TWA = 1 mg/M3(SKIN)

MAK INFORMATION: 1 calculated as total dust mG/M3
Substance with systemic effects, onset of effect over 2 hours: Peak = 10xMAK for 30 minutes, once per shift of 8 hours.
Danger of cutaneous absorption

CARCINOGEN?: Y STATUS: See below
REFERENCES:

ANIMAL POSITIVE IARC** 5,83,74
HUMAN INDEFINITE IARC** 5,83,74

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-man TDLo:6 mg/kg CMEP** -,1,56
BEHAVIORAL
Headache
GASTROINTESTINAL
Nausea or vomiting
SKIN AND APPENDAGES
Other
Sweating

orl-hmn TDLo:16 mg/kg CMEP** -,1,56
BEHAVIORAL
Convulsions or effect on seizure threshold

orl-hmn LDLo:500 mg/kg 85KYAH 11,446,89
BEHAVIORAL
Convulsions or effect on seizure threshold
CARDIAC
Arrythmias(including changes in conduction)
LUNGS, THORAX, OR RESPIRATION
Other changes

orl-hmn TDLo:5 mg/kg PHARAT 2,268,47
BEHAVIORAL
General anesthetic
BEHAVIORAL

Analgesia

LD50 value: orl-rat LD50:87 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-inf LDLo:150 mg/kg
orl-rat LD50:87 mg/kg
skn-rat LD50:1931 mg/kg
ipr-rat LD50:9100 ug/kg
scu-rat LD50:1500 mg/kg
ivn-rat LD50:68 mg/kg
unr-rat LD50:300 mg/kg
orl-mus LD50:135 mg/kg
ipr-mus LD50:32 mg/kg
ivn-mus LD50:68500 ug/kg
orl-dog LD50:150 mg/kg
ivn-dog LDLo:75 mg/kg
orl-mky LD50:200 mg/kg
ivn-mky LDLo:50 mg/kg
orl-cat LDLo:250 mg/kg
ivn-cat LDLo:40 mg/kg
orl-rbt LD50:250 mg/kg
skn-rbt LD50:300 mg/kg
scu-rbt LD50:250 mg/kg
ivn-rbt LDLo:50 mg/kg
orl-gpg LD50:150 mg/kg
skn-gpg LD50:1 gm/kg
scu-gpg LD50:900 mg/kg
orl-ham LD50:>5 gm/kg
orl-ckn LDLo:300 mg/kg
orl-frg LD50:7600 ug/kg
par-frg LD50:24100 ug/kg
orl-dom LDLo:300 mg/kg
unr-mam LD50:200 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:112 mg/kg (56D male) IJEBA6 16,1002,78
PATERNAL EFFECTS
Spermatogenisis
PATERNAL EFFECTS
Testes,epididymis,sperm duct

orl-rat TDLo:100 mg/kg (1D male) FCTXAV 11,53,73
EFFECTS ON FERTILITY
Pre-implantation mortility

orl-rat TDLo:430 mg/kg (1-22D preg/21D post) BECTA6 12,373,74
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

orl-rat TDLo:1890 mg/kg (36W pre) AECTCV 3,479,75/76
EFFECTS ON FERTILITY
Female fertility index

orl-rat TDLo:250 mg/kg (15-19D preg) BNEOBV 26,283,75
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

orl-rat TDLo:50 mg/kg (1D male) FCTXAV 11,53,73
EFFECTS ON FERTILITY
Other measures of fertility

ipr-rat TDLo:60 mg/kg (3D pre) TXAPA9 18,348,71
MATERNAL EFFECTS
Uterus,cervix,vagina

ipr-rat TDLo:21 mg/kg (21D post) NATUAS 228,1222,70
EFFECTS ON NEWBORN
Weaning or lactation index(#alive at weaning per # alive at day 4)
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

orl-mus TDLo:504 mg/kg (21D post) ENPBBC 4,189,74
EFFECTS ON NEWBORN
Behavioral

orl-mus TDLo:81 mg/kg (4W male/4W pre-2W post) TXAPA9 10,54,67
EFFECTS ON FERTILITY
Other measures of fertility

orl-mus TDLo:124 mg/kg (62D pre) ENPBBC 3,127,73
MATERNAL EFFECTS
Menstrual cycle changes or disorders

orl-mus TDLo:148 mg/kg (66D pre/1-8D preg) ENPBBC 3,127,73
EFFECTS ON FERTILITY
Pre-implantation mortility

ipr-mus TDLo:40 mg/kg (1-3D preg) BECTA6 9,267,73
EFFECTS ON FERTILITY
Pre-implantation mortility

ipr-mus TDLo:40 mg/kg (1D pre) AMBOCX 1,148,72
MATERNAL EFFECTS
Menstrual cycle changes or disorders

scu-mus TDLo:418 mg/kg (6-14D preg) NTIS** PB223-160
EFFECTS ON EMBRYO OR FETUS
Extra embryonic features(e.g.,placenta,umbilical cord)

scu-mus TDLo:143 mg/kg (21D post) ENPBBC 5,54,75
EFFECTS ON NEWBORN
Delayed effects

scu-mus TDLo:40 mg/kg (3D pre) IJMRAQ 65,576,77
MATERNAL EFFECTS
Ovaries,fallopian tubes
MATERNAL EFFECTS
Uterus,cervix,vagina
MATERNAL EFFECTS
Menstrual cycle changes or disorders

unr-mus TDLo:3 mg/kg (10-17D preg) TXAPA9 22,327,72
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system
EFFECTS ON NEWBORN
Delayed effects

unr-mus TDLo:17500 ug/kg (8-14D preg) PSYPAG 12,424,68
EFFECTS ON NEWBORN
Behavioral

orl-dog TDLo:3540 mg/kg (multigenerations) AECTCV 6,83,77
MATERNAL EFFECTS
Parturition
EFFECTS ON NEWBORN
Delayed effects

California Prop 65: Carcinogen (10/01/87)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
p,p'-Dichlorodiphenyltrichloroethane (DDT); CASRN 50-29-3 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- p,p'-Dichlorodiphenyltrichloroethane (DDT)
CASRN -- 50-29-3
Last Revised -- 05/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a

low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen.

Basis -- Observation of tumors (generally of the liver) in seven studies in various mouse strains and three studies in rats. DDT is structurally similar to other probable carcinogens, such as DDD and DDE.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. The existing epidemiological data are inadequate. Autopsy studies relating tissue levels of DDT to cancer incidence have yielded conflicting results. Three studies reported that tissue levels of DDT and DDE were higher in cancer victims than in those dying of other diseases (Casarett et al., 1968; Dacre and Jennings, 1970; Wasserman et al., 1976). In other studies no such relationship was seen (Maier-Bode, 1960; Robinson et al., 1965; Hoffman et al., 1967). Studies of occupationally exposed workers and volunteers have been of insufficient duration to be useful in assessment of the carcinogenicity of DDT to humans.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Twenty-five animal carcinogenicity assays have been reviewed for DDT. Nine feeding studies, including two multigenerational studies, have been conducted in the following mouse strains: BALB/C, CF-1, A strain, Swiss/Bombay and (C57B1)x(C3HxAkR). Only one of these studies, conducted for 78 weeks, showed no indication of DDT tumorigenicity (NCI, 1978). Both hepatocellular adenomas and carcinomas were observed in six mouse liver tumor studies (Walker et al., 1973; Thorpe and Walker, 1973; Kashyap et al., 1977; Innes et al., 1969; Terracini et al., 1973; Turusov et al., 1973). Both benign and malignant lung tumors were observed in two studies wherein mice were exposed both in utero and throughout their lifetime (Shabad et al., 1973; Tarjan and Kemeny, 1969). Doses producing increased tumor incidence ranged from 0.15-37.5 mg/kg/day.

Three studies using Wistar, MRC Porton and Osborne-Mendel rats and doses from 25-40 mg/kg/day produced increased incidence of benign liver tumors (Rossi et al., 1977; Cabral et al., 1982; Fitzhugh and Nelson, 1946). Another study wherein Osborne-Mendel rats were exposed in this dietary dose range for 78 weeks was negative (NCI, 1978) as were three additional assays in which lower doses were given.

Tests of DDT in hamsters have not resulted in increased tumor incidence. Unlike mice and humans, hamsters accumulate DDT in tissue but do not metabolize it to DDD or DDE. Studies of DDT in dogs (Lehman, 1951, 1965) and monkeys (Adamson and Sieber, 1979, 1983) have not shown a carcinogenic effect. However, the length of these studies (approximately 30% of the animals' lifetimes) was insufficient to assess the carcinogenicity of DDT. DDT has been shown to produce hepatomas in trout (Halver, 1967).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

DDT has been shown to act as a liver tumor promoter in rats initiated with 2-acetylaminofluorene, 2-acetamidophenanthrene or trans-4-acetylaminostilbene (Peraino et al., 1975; Scribner and Mottet, 1981; Hilpert et al., 1983).

DDT has produced both negative and positive responses in tests for genotoxicity. Positive responses have been noted in V79 mutation assays, for chromosome aberrations in cultured human lymphocytes, and for sister chromatid exchanges in V79 and CHO cells (Bradley et al., 1981; Rabello et al., 1975; Preston et al., 1981; Ray-Chaudhuri et al., 1982). In one study, DDT was reported to interact directly with DNA; this result was not confirmed in the absence of a metabolizing system (Kubinski et al., 1981; Griffin and Hill, 1978).

DDT is structurally related to the following chemicals which produce liver tumors in mice: DDE, DDD, dicofol and chlorobenzilate.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 3.4E-1 per (mg/kg)/day

Drinking Water Unit Risk -- 9.7E-6 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration

E-4 (1 in 10,000)	1E+1 ug/L
E-5 (1 in 100,000)	1E+0 ug/L
E-6 (1 in 1,000,000)	1E-1 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- Liver, benign and malignant (see table)
Test Animals -- mouse and rat (see table)
Route -- diet
Reference -- see table

Species/Strain Tumor Type	Slope Factor Male	Female	Reference
Mouse/CF-1, Benign	0.80	0.42	Turusov et al., 1973
Mouse/BALB/C, Benign	0.082		Terracini et al., 1973
Mouse/CF-1, Benign, Malignant	0.52	0.81	Thorpe and Walker, 1973
Mouse/CF-1, Benign	1.04	0.49	Tomatis and Turusov, 1975
Rat/MRC Porton		0.084	Cabral et al., 1982
Rat/Wistar, Benign	0.16	0.27	Rossi et al., 1977

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

The estimate of the slope factor did not increase in the multigeneration feeding studies (Terracini et al., 1973; Turusov et al., 1973) but remained the same from generation to generation. A geometric mean of the above slope factors was used for the overall slope factor of 3.4E-1. This was done in order to avoid excluding relevant data (note that the appropriateness of this procedure is currently under study by U.S. EPA). All tumors were of the liver; there were no metastases. A few malignancies were observed in the Turusov study; possible neoplasms were indicated in the Terracini and Tomatis studies. The Turusov study was carried out over six generations, the Terracini assay for two. The slope factor derived from data of Tarjan and Kemeny (1969) was not included in the calculation of the geometric mean because the tumors developed at different sites than in any other studies. In addition, there was a problem in this study with possible DDT contamination of the feed.

DDT is known to be absorbed by humans in direct proportion to dietary exposure; t(1/2) for clearance is 10-20 years.

The unit risk should not be used if the water concentraion exceeds 1E+3 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Ten slope factors derived from six studies were within a 13-fold range. The slope factor derived from the mouse data alone was 4.8E-1 while that derived from the rat data alone was 1.5E-1. There was no apparent difference in slope factor as a function of sex of the animals. The geometric mean of the slope factors from the mouse and rat data combined was identical for the same tumor site as that for DDE [3.4E-1 per (mg/kg)/day], a structural analog.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 9.7E-5 (ug/cu.m)

Extrapolation Method -- Linear multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	1E+0 ug/cu.m
E-5 (1 in 100,000)	1E-1 ug/cu.m
E-6 (1 in 1,000,000)	1E-2 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

The inhalation risk estimates were calculated from the oral data presented in Section II.B.2.

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if the air concentration exceeds 1E+2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

This inhalation risk estimate was calculated from the oral data presented in Section II.B.2.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. The Carcinogenic Assessment Groups Calculation of the Carcinogenicity of Dicofol (Kelthane), DDT, DDE and DDD (TDE). Prepared by the Office of Health and Environmental Assessment, Carcinogen Assessment Group, Washington, DC for the Hazard Evaluation Division, Office of Toxic Substances, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The U.S. EPA risk assessment document on DDT is an internal report and has not received external review.

Agency Work Group Review: 10/29/86, 11/12/86, 06/24/87

Verification Date: 06/24/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

James W. Holder / ORD -- (202)260-5721 / FTS 260-5721

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

ARCINOGENICITY ASSESSMENT)

James W. Holder / ORD -- (202)260-5721 / FTS 260-5721

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
data not available.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:

Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes contaminated.

** WORK CLOTHING SHOULD BE CHANGED DAILY:
If there is any reasonable possibility that the clothing may be contaminated

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (DDT)
Greater at any detectable concentration. : Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INGESTION: treatment should be done by a physician. It usually includes gastric lavage and administration of saline cathartic, phenobarbital, and parenteral fluids. Patient should be kept quiet and under observation for at least 24 hours.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Water, foam, dry chemical, or carbon dioxide. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
DOT ID NUMBER: UN2761

ERG93 GUIDE 55

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous; may be fatal if inhaled, swallowed or absorbed through skin.
Contact may cause burns to skin and eyes.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.
Fire may produce irritating or poisonous gases.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Container may explode violently in heat of fire.
Material may be transported in a molten form.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and chemical protective clothing which is specifically recommended by the shipper or manufacturer may be worn. It may provide little or no thermal protection.
*Structural firefighters' protective clothing is not effective for these materials. See the Table of Initial Isolation and Protective Action Distances. If you find the ID Number and the name of the material there, begin protective action. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300.
*FIRE
Small Fires: Dry chemical, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Fight fire from maximum distance. Stay away from ends of tanks.
Dike fire control water for later disposal; do not scatter the material.
*SPILL OR LEAK
Do not touch or walk through spilled material; stop leak if you can do it without risk. Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Use water spray to reduce vapors.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

CHEMTOX DATA

------------------------------- IDENTIFIERS -------------------------------

CHEMTOX RECORD 145 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: DDE

SYNONYMS: 2,2-BIS(p-CHLOROPHENYL)-1,1-DICHLOROETHYLENE; DDE; p,p'-DDE; DDT DEHYDROCHLORIDE; 1,1-DICHLORO-2,2-BIS(p-CHLOROPHENYL)ETHYLENE; p,p'-DICHLORODIPHENYL DICHLOROETHYLENE; 1,1'-DICHLOROETHENYLIDENE)BIS(4-CHLOROBENZENE); NCI-C00555; 4,4' DDE; 1,1'-DICHLOROETHYLIDENE BIS-(4-CHLOROBENZENE)

CAS: 3547-04-4 RTECS: KH5460000

FORMULA: C14H8Cl4 MOL WT: 318.02

WLN: GYGUYR DG

CHEMICAL CLASS:Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES -------------------------------

PHYSICAL DESCRIPTION:	colorless crystals		
BOILING POINT:	NA		
MELTING POINT:	361 K	87.8 C	190.1 F
FLASH POINT:	Not available		
AUTO IGNITION:	Not available		
VAPOR PRESSURE:			
UEL:	~		
LEL:	~		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	No data		
DENSITY:			
WATER SOLUBILITY:	< 1mg/mL @ 21 C		
INCOMPATIBILITIES:			

REACTIVITY WITH WATER: No data on water reactivity

REACTIVITY WITH COMMON MATERIALS: MAY BE OXIDIZES TO p,p'-DICHLORODIBENZOPHENOME WHEN CATALYZED BY ULTRA-VIOLET LIGHT; STABLE TO CONCENTRATED SULFURIC ACID Source: CSDS

STABILITY DURING TRANSPORT: No Data

NEUTRALIZING AGENTS: No data

POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: VERY TOXIC FUMES OF HYDROGEN CHLORIDE

ODOR DETECTED AT (ppm): Unknown

ODOR DESCRIPTION: No data

100 % ODOR DETECTION: No data

------------------------------- REGULATIONS ----------------------------------

DOT hazard class:	9 CLASS 9
DOT guide:	31
Identification number:	UN3077
DOT shipping name:	ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (DDE)
Packing group:	III
Label(s) required:	CLASS 9
Special provisions:	8, B54
Packaging exceptions:	173.155
Non bulk packaging:	173.213
Bulk packaging:	173.240
Quantity limitations-	
Passenger air/rail:	NONE
Cargo aircraft only:	NONE
Vessel stowage:	A
Other stowage provisions:	

STCC NUMBER:	Not listed
CLEAN WATER ACT Sect.307:	Yes
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	None
CERCLA REF:	Y
RQ DESIGNATION:	X 1 pound (0.454 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin (Prop 65). Chronic toxicity: carcinogen

UNITED STATED POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:

HEALTH HAZARD (BLUE):	Unspecified
FLAMMABILITY (RED) :	Unspecified
REACTIVITY (YELLOW):	Unspecified
SPECIAL :	Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act of November 15, 1990. List of pollutants.

Clean Water Act Section 307 Priority Pollutants
DDE [3547-04-4]
DOT Hazardous Materials Table. 49 CFR 172.101
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
SARA Section 110 Priority List of CERCLA Hazardous Substances
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)

------------------------------ TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: induces microsomal enzymes. ** source: 7

TARGET ORGANS:

SYMPTOMS: NAUSEA AND VOMITING; IRRITATION OF EYES. CHRONIC SYMPTOMS INCLUDE HEPATIC DAMAGE, CENTRAL NERVOUS SYSTEM DEGENERATION, AGRANULOCYTOSIS, DERMATITIS, WEAKNESS, CONVULSIONS, COMA AND DEATH Source: CSDS

CONC IDLH: Nonegiven

NIOSH REL: Not given

ACGIH TLV: Not listed
ACGIH STEL: Not listed

OSHA PEL: Not in Table Z-1-A

MAK INFORMATION: Not listed

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

LD50 value: orl-rat LD50:1 gm/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:1 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ipr-rat TDLo:3500 ug/kg (7D pre) ENDOAO 91,1095,72
MATERNAL EFFECTS
Uterus,cervix,vagina

California Prop 65: Carcinogen (01/01/89)
No significant risk level 2. ugD (01/01/94)
No significant risk level 2. ugD (01/01/94)
No significant risk level 2. ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
p,p'-Dichlorodiphenyldichloroethylene (DDE); CASRN 72-55-9 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- p,p'-Dichlorodiphenyldichloroethylene (DDE)
CASRN -- 72-55-9
Last Revised -- 08/22/88

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- increased incidence of liver tumors including carcinomas in two strains of mice and in hamsters and of thyroid tumors in female rats by diet.

___II.A.2. HUMAN CARCINOGENICITY DATA

Human epidemiological data are not available for DDE. Evidence for the carcinogenicity in humans of DDT, a structural analog, is based on autopsy studies relating tissue levels of DDT to cancer incidence. These studies have yielded conflicting results. Three studies reported that tissue levels of DDT and DDE were higher in cancer victims than in those dying of other diseases (Casarett et al., 1968; Dacre and Jennings, 1970; Wasserman et al., 1976). In other studies no such relationship was seen (Maier-Bode, 1960; Robinson et al., 1965; Hoffman et al., 1967). Studies of volunteers and workers occupationally exposed to DDT have been of insufficient duration to determine the carcinogenicity of DDT to humans.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. NCI (1978) administered DDE in feed at TWA doses of 148 and 261 ppm to 50 B6C3F1 mice/sex/dose for 78 weeks. After an additional 15 weeks, a dose-dependent and statistically significant increase in incidence of hepatocellular carcinomas was observed in males and females in comparison with controls. Increased weight loss and mortality was observed in females.

Tomatis et al. (1974) administered 250 ppm DDE in feed for lifetime (130 weeks) to 60 CF-1 mice/sex. A statistically significant increase in incidence of hepatomas was observed in both males and females in comparison with controls. In females, 98% of the 55 surviving exposed animals developed hepatomas, compared to 1% of the surviving controls.

Rossi et al. (1983) administered DDE in feed for 128 weeks to 40-46 Syrian Golden hamsters/sex/dose at doses of 500 and 1000 ppm. After 76 weeks, a statistically significant increase in incidence of neoplastic nodules of the liver were observed in both sexes in comparison with vehicle-treated controls.

NCI (1978) also fed DDE at TWA doses of 437 and 839 ppm for males and 242 and 462 ppm for females for 78 weeks to 50 Osborne-Mendel rats/sex/ dose, with an additional 35 week observation period. A dose-dependent trend in incidence of thyroid tumors was observed in females which was statistically significant by the Cochran Armitage trend test after adjustment for survival. The Fischer Exact test, however, was not statistically significant. Overall, the results of the bioassay were not considered by NCI to provide convincing evidence for carcinogenicity.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

DDE was mutagenic in mouse lymphoma (L5178Y) cells and chinese hamster

(V79) cells, but not in Salmonella (ICPEMC, 1984). DDE is structurally similar to and a metabolite of DDT (Peterson and Robinson, 1964; Gingell and Wallcave, 1976; Morgan and Roan, 1977) which is a probable human carcinogen.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 3.4E-1/mg/kg/day

Drinking Water Unit Risk -- 9.7E-6/ug/L

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	1E+1 ug/L
E-5 (1 in 100,000)	1 ug/L
E-6 (1 in 1,000,000)	1E-1 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hepatocellular carcinomas, hepatomas
Test Animals -- mouse/B6C3F1; mouse/CF-1; hamsters/Syrian Golden
Route -- diet
Reference -- NCI, 1978; Tomatis et al., 1974; Rossi et al., 1983

Administered Dose (ppm)	Human Equivalent Dose (mg/kg)/day	Tumor Incidence female	male	Reference
Mouse/B6C3F1; hepatocellular carcinomas				
0	0.0	0/19	0/19	NCI, 1978
148	0.90	19/47	7/41	
261	1.584	34/48	17/47	
Mouse/CF-1; hepatomas				
0	0	1/90	33/98	Tomatis et al., 1974
250	2.45	54/55	39/53	
Hamsters/Syrian Golden; neoplastic nodules (hepatomas)				
0	0	0/31	0/42	Rossi et al., 1983
500	4.79	7/30	4/39	
1000	9.57	8/39	6/39	

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

NCI (1978) used DDE of about 95% purity, while that used by Tomatis et al. (1974) and Rossi et al. (1983) was 99% pure. In the hamster study, Rossi et al. described the observed lesions as neoplastic liver nodules or hepatocellular tumors, using these terms interchangeably. The oral quantitative estimate is a geometric mean of six slope factors computed from incidence data by sex from the studies cited in Section II.A.3.

The unit risk should not be used if the water concentration exceeds 1E+3 ug/L, since above this concentration the slope factor may differ from that stated.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

An adequate number of animals was observed. The geometric mean obtained using the slope factors from the mouse studies alone is 7.8E-1/mg/kg/day. This is within a factor of 2 of that derived from the mouse and hamster studies combined. In addition, the slope factor for DDE was within a factor of 2 of the slope factors for liver tumors for three structurally similar compounds: DDT, 3.4E-1/mg/kg/day; DDD, 2.4E-1/mg/kg/day; and Dicofol, 4.4E-1/mg/kg/day.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1980. Hazard Assessment Report on DDT, DDD, DDE. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

U.S. EPA. 1985. The Carcinogen Assessment Group's Calculation of the Carcinogenicity of Dicofol (Kelthane), DDT, DDE and DDD (TDE). Prepared by the Office of Health and Environmental Assessment, Carcinogen Assessment

Group, Washington, DC for the Hazard Evaluation Division, Office of Toxic Substances, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1985 Carcinogen Assessment Group's report has received Agency review. The 1980 Hazard Assessment Report has received peer review.

Agency Work Group Review: 06/24/87

Verification Date: 06/24/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

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Chao Chen / ORD -- (202)260-5719 / FTS 260-5719

Chao Chen / ORD -- (202)260-5719 / FTS 260-5719

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. (DDE)
DOT ID NUMBER: UN3077

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POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Material may be transported hot.
*HEALTH HAZARDS

Contact may cause burns to skin and eyes.
Inhalation of asbestos dust may have a damaging effect on the lungs.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.
Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
*Do not scatter spilled material with high-pressure water streams.
Dike fire control water for later disposal.

*SPILL OR LEAK

Stop leak if you can do it without risk.
Avoid inhalation of asbestos dust.
Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
Cover powder spill with plastic sheet or tarp to minimize spreading.

*FIRST AID

In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS ----------------------------------

CHEMTOX RECORD 387 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: TDE

SYNONYMS: 1,1-BIS(p-CHLOROPHENYL)-2,2-DICHLOROETHANE;
1,1-BIS(4-CHLOROPHENYL)-2,2-DICHLOROETHANE;
2,2-BIS(p-CHLOROPHENYL)-1,1-DICHLOROETHANE;
2,2-BIS(4-CHLOROPHENYL)-1,1-DICHLOROETHANE; DDD; p,p'-DDD;
1,1-DICHLOOR-2,2-BIS(4-CHLOOR FENYL)-ETHAAN (Dutch);
1,1-DICHLOR-2,2-BIS(4-CHLOR-PHENYL)-AETHAN (German);
1,1-DICHLORO-2,2-BIS(p-CHLOROPHENYL)ETHANE;
1,1-DICHLORO-2,2-BIS(4-CHLOROPHENYL)-ETHANE (French);
1,1-DICHLORO-2,2-BIS(PARACHLOROPHENYL)ETHANE;
1,1-DICHLORO-2,2-DI(4-CHLOROPHENYL)ETHANE;
DICHLORODIPHENYL DICHLOROETHANE;
p,p'-DICHLORODIPHENYLDICHLOROETHANE;
1,1-DICLORO-2,2-BIS(4-CLORO-FENIL)-ETANO (Italian);
DILENE; ENT 4,225; ME-1700; NCI-C00475; RHOTHANE; RHOTHANE
D-3; ROTHANE; TDE; p,p'-TDE; TETRACHLORODIPHENYLETHANE;
1,1-DICHLORO-2,2-BIS(P-CHLOROPHENYL)ETHANE; 4,4' DDD;
DICHLORO DIPHENYL DICHLORETHANE;
1,1-DICHLORO-2,2-BIS(P-CHLORPHENYL)ETHANE

CAS: 72-54-8 RTECS: KI0700000

FORMULA: C14H10Cl4 MOL WT: 320.04

WLN: GYGYR DG

CHEMICAL CLASS: Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ----------------------------------

PHYSICAL DESCRIPTION:	cream colored, crystalline solid		
BOILING POINT:	NA		
MELTING POINT:	383.15 K	110 C	230 F
FLASH POINT:	Not available		
AUTO IGNITION:	Not available		
VAPOR PRESSURE:			
UEL:	~		
LEL:	~		
VAPOR DENSITY:	11 (air=1)		
SPECIFIC GRAVITY:	1.476 20C		
DENSITY:	1.467 g/mL @ 20 C		
WATER SOLUBILITY:	< 1 mg/mL @ 18 C		
INCOMPATIBILITIES:			

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data

POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES:	TOXIC FUMES OF HYDROGEN CHLORIDE
ODOR DETECTED AT (ppm):	Data not available
ODOR DESCRIPTION:	Data not available Source:CHRIS
100 % ODOR DETECTION:	No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class:	6.1 POISON
DOT guide:	55
Identification number:	UN2761
DOT shipping name:	ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
Packing group:	III
Label(s) required:	KEEP AWAY FROM FOOD
Special provisions:	
Packaging exceptions:	173.153
Non bulk packaging:	173.213
Bulk packaging:	173.240
Quantity limitations-	
Passenger air/rail:	100 KG
Cargo aircraft only:	200 KG
Vessel stowage:	A
Other stowage provisions:	40

STCC NUMBER: 4940370

CLEAN WATER ACT Sect.307:	Yes
CLEAN WATER ACT Sect.311:	Yes
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	U060
CERCLA REF:	Y
RQ DESIGNATION:	X 1 pound (0.454 kg) CERCLA
SARA TPQ VALUE:	Not listed

SARA Sect. 312
categories:

Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin (Prop 65).
Chronic toxicity: carcinogen

UNITED STATED POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:
HEALTH HAZARD (BLUE): Unspecified
FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified

SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ATSDR Toxicology Profile available (NTIS** PB/90/182171/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
Clean Water Act Section 307 Priority Pollutants
Clean Water Act Section 311 Hazardous Chemicals List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
Second Third Wastes List. 40 CFR 268.11. 54 FR 26594 (June 23, 1989)
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
TDE [72-54-8]
Washington State Discarded Chemical Products List, November 17, 1989

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: may cause irritation to nose and throat. SKIN: may cause slight irritation. Eyes: may cause irritation. INGESTION: clinical doses of 1/30 ounce per day have caused lethargy, nausea, vomiting, diarrhea, loss of appetite and weight loss. doses of 1/4 ounce have caused psychological disturbances. estimated lethal dose is about 1/2 pound.(NYDH)

LONG TERM TOXICITY: long term ingestion has caused effects on the adrenal glands. ddd causes cancer in mice and genetic damage in other laboratory studies. whether these effects occur in humans is not known.(NYDH)

TARGET ORGANS:

SYMPTOMS: Ingestion causes vomiting and delayed symptoms similar to those caused by DDT. Contact with eyes causes irritation. Source: CHRIS

CONC IDLH: Nonegiven

NIOSH REL: Not given

ACGIH TLV: Not listed
ACGIH STEL: Not listed

OSHA PEL: Not in Table Z-1-A

MAK INFORMATION: Not listed

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

LD50 value: orl-rat LD50:113 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:113 mg/kg
orl-mus LDLo:600 mg/kg
skn-rbt LD50:1200 mg/kg
orl-ham LD50:>5 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Carcinogen (01/01/89)

----------------------------- EPA's IRIS DATA SUMMARY -------------------------
p,p'-Dichlorodiphenyl dichloroethane (DDD); CASRN 72-54-8 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- p,p'-Dichlorodiphenyl dichloroethane (DDD)
CASRN -- 72-54-8
Last Revised -- 08/22/88

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day.

The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- based on an increased incidence of lung tumors in male and female mice, liver tumors in male mice and thyroid tumors in male rats. DDD is structurally similar to, and is a known metabolite of DDT, a probable human carcinogen.

___II.A.2. HUMAN CARCINOGENICITY DATA

None. Human epidemiological data are not available for DDD. Evidence for the carcinogenicity in humans of DDT, a structural analog, is based on autopsy studies relating tissue levels of DDT to cancer incidence. These studies have yielded conflicting results. Three studies reported that tissue levels of DDT and DDE were higher in cancer victims than in those dying of other diseases (Casarett et al., 1968; Dacre and Jennings, 1970; Wasserman et al., 1976). In other studies no such relationship was seen (Maier-Bode, 1960; Robinson et al., 1965; Hoffman et al., 1967). Studies of occupationally exposed workers and volunteers have been of insufficient duration to determine the carcinogenicity of DDT to humans.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Tomatis et al. (1974) fed DDD for 130 weeks at 250 ppm (TWA) to 60 CF-1 mice/sex. A statistically significant increase in incidence of lung tumors was seen in both sexes compared with controls. In males, a statistically significant increase in incidence of liver tumors was also seen.

NCI (1978) fed DDD at 411 and 822 ppm (TWA) to 50 B6C3F1 mice/sex/dose for 78 weeks. Actual doses were 350 or 630 ppm for 5 weeks, 375 or 750 ppm for 11 weeks, and 425 or 850 ppm for the next 62 weeks. After an additional 15 weeks, an increased incidence of hepatocellular carcinomas was seen in both sexes by comparison to controls, but the increase was not statistically significant.

NCI (1978) also fed DDD at 1647 and 3294 ppm TWA for males and 850 and 1700 ppm TWA for females for 78 weeks to 50 Osborne-Mendel rats/sex/dose. Males were fed 1400 or 2800 ppm for 23 weeks followed by 1750 or 3500 ppm for 55 weeks. Females were fed 850 or 1700 ppm for the entire 78 weeks. After an additional 35 weeks, an increased incidence of thyroid tumors (follicular cell adenomas and carcinomas) was observed in males. Due to a wide variation in incidence of these tumors in the control groups for DDD, DDE and DDT, the increased incidence was not statistically significant by comparison to concurrent controls. Although tumor incidence did not appear to be dose-related, the increase was significant at the low dose by comparison to historical controls. Thus, the pathologists' judgment and statistical results suggest a possible carcinogenic effect of DDD in male rats. NCI concluded that a definitive interpretation of the data was not possible.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

DDD is structurally similar to, and is a metabolite of, DDT, a probable human carcinogen, in rats (Peterson and Robinson, 1964), mice (Gingell and Wallcave, 1976), and humans (Morgan and Roan, 1977).

Positive effects were found with DDD in mammalian cytogenetic assays and a host-mediated assay (ICPEMC, 1984).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 2.4E-1/mg/kg/day

Drinking Water Unit Risk -- 6.9E-6/ug/L

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	1E+1 ug/L
E-5 (1 in 100,000)	1 ug/L
E-6 (1 in 1,000,000)	1E-1 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- liver
Test Animals -- mouse/CF-1, males
Route -- diet
Reference -- Tomatis et al., 1974

Administered Dose (ppm)	Human Equivalent Dose (mg/kg)/day	Tumor Incidence
0	0	33/98
250	245	31/59

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

DDD used in the Tomatis study was 99% pure p,p'-isomer. In the NCI bioassay, technical grade DDD was used, in which 60% of the material consisted of the p,p'-isomer. The composition of the remaining 40% was unspecified, but it was stated that analysis by gas chromatography revealed at least 19 impurities.

The unit risk should not be used if the water concentration exceeds 1E+3 ug/L, since above this concentration the slope factor may differ from that stated.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

An adequate number of animals was tested. The slope factor was calculated using tumor incidence data from only one dose. The slope factor was similar to, and within a factor of 2, of the slope factors for this same site of three other structurally similar compounds: DDT, 3.4E-1/mg/kg/day; DDE, 3.4E-1/mg/kg/day; and dicofol, 4.4E-1/mg/kg/day.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1980. Hazard Assessment Report on DDT, DDD, DDE. Prepared by the

Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH.

U.S. EPA. 1985. The Carcinogenic Assessment Group's Calculation of the Carcinogenicity of Dicofol (Kelthane), DDT, DDE and DDD (TDE). Prepared by the Office of Health and Environmental Assessment, carcinogen Assessment Group, Washington, DC, for the Hazard Evaluation Division, Office of Toxic Substances, Washington, DC. (Internal Report) EPA-600/X-85-097.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1985 Carcinogen Assessment Group's report has received Agency review.

The 1980 Hazard Assessment Report has received peer review.

Agency Work Group Review: 06/03/87, 06/24/87

Verification Date: 06/24/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

James H. Holder / ORD -- (202)260-5721 / FTS 260-5721

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

/ FTS 260-5898

----------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
dust mask; goggles or face shield; rubber gloves.

FIRST AID SOURCE: CHRIS Manual 1991
INGESTION: treatment should be given by a physician and is similar to that given following ingestion of DDT.
EYES: flush with water.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated

clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Water, foam, dry chemical, carbon dioxide. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
DOT ID NUMBER: UN2761

ERG93 GUIDE 55

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous; may be fatal if inhaled, swallowed or absorbed through skin.
Contact may cause burns to skin and eyes.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.
Fire may produce irritating or poisonous gases.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Container may explode violently in heat of fire.
Material may be transported in a molten form.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and chemical protective clothing which is specifically recommended by the shipper or manufacturer may be worn. It may provide little or no thermal protection.
*Structural firefighters' protective clothing is not effective for these materials. See the Table of Initial Isolation and Protective Action Distances. If you find the ID Number and the name of the material there, begin protective action. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300.
*FIRE
Small Fires: Dry chemical, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Fight fire from maximum distance. Stay away from ends of tanks.
Dike fire control water for later disposal; do not scatter the material.
*SPILL OR LEAK
Do not touch or walk through spilled material; stop leak if you can do it without risk. Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Use water spray to reduce vapors.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

CHEMTOX DATA

------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 100 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: CHLORDANE

SYNONYMS: ASPON-CHLORDANE; BELT; CD 68; CHLOORDAAN (Dutch); CHLORDAN; gamma-CHLORDAN; CHLORDANE; CHLORDANE, LIQUID ; CHLORINDAN; CHLOR KIL; CHLORODANE; CLORDAN (Italian); CORODANE; CORTILAN-NEU; DICHLOROCHLORDENE; DOWCHLOR; ENT 9,932; ENT 25,552-X; HCS 3260; KYPCHLOR; M 140; M 410; 4,7-METHANO-1H-INDENE, 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3a,4,7,7a-HEXAHYDRO-; NCI-C00099; NIRAN; OCTACHLOR; OCTACHLORODIHYDRODICYCLOPENTADIENE; 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3a,4,7,7a-HEXAHYDRO-4,7-METHANOINDENE; 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3a,4,7,7a-HEXAHYDRO-4,7-METHANO-1H-INDENE; 1,2,4,5,6,7,8,8-OCTACHLORO-3a,4,7,7a-HEXAHYDRO-4,7-METHYLENE INDANE; OCTACHLORO-4,7-METHANOHYDROINDANE; OCTACHLORO-4,7-METHANOTETRAHYDROINDANE; 1,2,4,5,6,7,8,8-OCTACHLORO-4,7-METHANO-3a,4,7,7a-TETRAHYDROINDANE; 1,2,4,5,6,7,8,8-OCTACHLOOR-3a,4,7,7a-TETRAHYDRO-4,7-endo-METHANO-INDAAN (Dutch); 1,2,4,5,6,7,8,8-OCTACHLORO-3a,4,7,7a-TETRAHYDRO-4,7-METHANOINDAN; 1,2,4,5,6,7,8,8-OCTACHLORO-3a,4,7,7a-TETRAHYDRO-4,7-METHANOINDANE; 1,2,4,5,6,7,10,10-OCTACHLORO-4,7,8,9-TETRAHYDRO-4,7-METHYLENEINDANE; 1,2,4,5,6,7,8,8-OCTACHLOR-3a,4,7,7a-TETRAHYDRO-4,7-endo-METHANO-INDAN (German); OCTA-KLOR; OKTATERR; 1,2,4,5,6,7,8,8-OTTOCHLORO-3a,4,7,7a-TETRAIDRO-4,7-endo-METANO-INDANO (Italian); ORTHO-KLOR; SD 5532; SHELL SD-5532; SYNKLOR; TAT CHLOR 4; TOPICHLOR 20; TOPICLOR; TOPICLOR 20; TOXICHLOR; VELSICOL 1068; 4,7-METHANOINDAN, 1,2,4,5,6,7,8,8-OCTACHLORO-3A,4,7,71-TETRAHYDRO-; 1,2,4,5,6,7,8,8-OCTACHLORO-3A,4,7,7A-TETRA-HYDRO-4,7-METHANOINDANE; CHLORDANE, TECHNICAL; (**)-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-4,7-METHANO-1H-INDENE (**)=1,24,5,6,7,8,8-; 4,7-METHANO-1H-INDENE, 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-; 4,7-METHANOINDAN, 1,2,4,5,6,7,8,8-OCTACHLORO-3A,4,7,7A-TETRAHYDRO-; .GAMMA.-CHLORDAN; OCTACHLOROHEXAHYDROMETHANOINDENE; 1-EXO,2-ENDO,4,5,6,7,8,8-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-4,7-METHANOINDENE; 1,2,4,5,6,7,8,8-OCTACHLORO-2,3,3A,4,7,7A-HEXAHYDRO-4,7-METHANO-1H-INDENE; 1,2,4,5,6,7,8,8-OCTACHLORO-4-7-METHANO-3.ALPHA.,4,7,7,.ALPHA.-TETRAHYDROINDANE; ORTHO KLOR; DOW-KLOR; VELSICOL-1068

CAS: 57-74-9 RTECS: PB9800000

FORMULA: C10H6Cl8 MOL WT: 409.80

WLN: L C555 A IUTJ AG AG BG DG EG HG IG JG

CHEMICAL CLASS: Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ----------------------------------

PHYSICAL DESCRIPTION:	viscous amber or pale-yellow liquid. may also occur as a white powder.(nydh)
BOILING POINT:	8.15 K DECOMPOSES75 C DECOMPOSES47 F DECOMPOSES
MELTING POINT:	375.9-381.9 K 102.7-108.7 C 216.9-227.7 F
FLASH POINT:	Not available
AUTO IGNITION:	483 K 209.8 C 409.8 F
VAPOR PRESSURE:	0.00001 @ 25 c
UEL:	5 %
LEL:	0.7 %
IONIZATION POTENTIAL (eV):	13.4
VAPOR DENSITY:	No data
SPECIFIC GRAVITY:	1.6 @ 25C
DENSITY:	1.57
WATER SOLUBILITY:	insoluble
INCOMPATIBILITIES:	strong oxidizers
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	LOSES CHLORINE IN PRESENCE OF ALKALINE REAGENTS Source: MI-10 DECOMPOSES IN WEAK ALKALIS Source: THIC,112
STABILITY DURING TRANSPORT:	STABLE TO 160F
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	WHEN HEATED TO DECOMPOSE, IT EMITS TOXIC FUMES OF HYDROGEN CHLORIDE
ODOR DETECTED AT (ppm):	Data not available
ODOR DESCRIPTION:	like chlorine Source:CHRIS
100 % ODOR DETECTION:	No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class:	6.1 POISON
DOT guide:	55
Identification number:	UN2761
DOT shipping name:	ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
Packing group:	III
Label(s) required:	KEEP AWAY FROM FOOD
Special provisions:	
Packaging exceptions:	173.153
Non bulk packaging:	173.213
Bulk packaging:	173.240
Quantity limitations-	
Passenger air/rail:	100 KG
Cargo aircraft only:	200 KG
Vessel stowage:	A
Other stowage provisions:	40
STCC NUMBER:	4909630, 4913170

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:Yes
National Primary Drinking Water Regulations
  Maximum Contaminant Levels (MCL):   0.002 mg/L (07/30/92)
  Maximum Contaminant Level Goals (MCLG): 0 mg/L (07/30/92)

CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U036,D020
CERCLA REF:	Y
RQ DESIGNATION:	X 1 pound (0.454 kg) CERCLA
SARA TPQ VALUE:	1000 pounds
SARA Sect. 312 categories:	Chronic toxicity: carcinogen Chronic toxicity: adverse effect to target organ after long period of exposure. Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin. Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat). Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).

LISTED IN SARA Sect 313:   Yes
de minimus CONCENTRATION: 0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Oxidizers - Mailable as ORM-D
Mailability: Domestic surface mail only
Max per parcel: 1 QT METAL; 1 PT OTHER

NFPA CODES:
   HEALTH HAZARD (BLUE): Unspecified
   FLAMMABILITY (RED) : Unspecified
   REACTIVITY (YELLOW): Unspecified
   SPECIAL   : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/90/168709/AS)
CHLORDANE [57-74-9]
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Department of Health Services Drinking Water Action List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
Clean Water Act Section 311 Hazardous Chemicals List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
First Third Wastes List. 40 CFR 268.10. 54 FR 26594 (June 23, 1989)

Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 313 Toxic Chemicals List
SARA Title III Extremely Hazardous Substance. Sections 302 and 304.
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

---------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: exposure to concentrations above the osha standard have produced blurred vision, cough, confusion, loss of muscle control, convulsions and delirium. death has resulted from overexposure. SKIN: absorption through the skin is rapid and contributes substantially to the adverse health effects listed above. Eyes: may cause severe irritation. INGESTION: as little as 1/5th of an ounce has produced vomiting, coughing, irritation of the mouth, throat and stomach, diarrhea, confusion, delirium and death.(NYDH)

LONG TERM TOXICITY: loss of appetite and weight, skin irritation, liver damage, exhaustion, blurred vision and death are possible due to the cumulative action of this insecticide. long term exposures resulted in elevated rates of cancer in mice. whether chlordane causes cancer in humans is unknown.(NYDH)

TARGET ORGANS: stomach, liver

SYMPTOMS: Moderately irritating to eyes and skin. Ingestion, absorption through skin, or inhalation of mist or dust may cause excitability, convulsions, nausea, vomiting, diarrhea, and some local irritation of the gastrointestinal tract. Source: CHRIS

CONC IDLH: 100MG/M3

NIOSH REL: Potential occupational carcinogen

ACGIH TLV: TLV = 0.5mg/M3 SKIN
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 0.5mg/M3(SKIN)
Final Rule Limits:

TWA = 0.5 mg/M3(SKIN)

MAK INFORMATION: 0.5 calculated as total dust mG/M3
Substance with systemic effects, onset of effect over 2 hours: Peak = 10xMAK for 30 minutes, once per shift of 8 hours.
Danger of cutaneous absorption
A compound which is justifiably suspected of having carcinogenic potential.

CARCINOGEN?: Y STATUS: See below
REFERENCES:
ANIMAL POSITIVE IARC** 20,45,79
HUMAN INDEFINITE IARC** 20,45,79

CARCINOGEN LISTS:
IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: A compound which is justifiably suspected of having carcinogenic potential.
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
orl-man TDLo:3071 ug/kg JTCTDW 20,291,83
BEHAVIORAL
Coma
LUNGS, THORAX, OR RESPIRATION
Dyspnea
GASTROINTESTINAL
Nausea or vomiting

orl-hmn LDLo:29 mg/kg CMEP** -,1,56
LIVER
Fatty liver degeneration

orl-wmn LDLo:120 ug/kg CMEP** -,1,56
BEHAVIORAL
Convulsions or effect on seizure threshold
BEHAVIORAL
Excitement
GASTROINTESTINAL
Gastritis

skn-hmn LDLo:428 mg/kg 34ZIAG -,648,69
BEHAVIORAL
Tremor

BEHAVIORAL
Convulsions or effect on seizure threshold
BEHAVIORAL
Ataxia

LD50 value: orl-rat LD50:200 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:200 mg/kg
skn-rat LD50:690 mg/kg
ipr-rat LD50:343 mg/kg
orl-mus LD50:145 mg/kg
ipr-mus LDLo:240 mg/kg
ivn-mus LD50:100 mg/kg
ihl-cat LC50:100 mg/m3/4H
orl-rbt LD50:100 mg/kg
skn-rbt LD50:780 mg/kg
ivn-rbt LDLo:10 mg/kg
orl-ham LD50:1720 mg/kg
orl-ckn LD50:220 mg/kg
orl-qal LD50:83 mg/kg
orl-dck LD50:1200 mg/kg
orl-dom LD50:50 mg/kg
orl-mam LD50:180 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-mus TDLo:3360 ug/kg (1-21D preg) JEPTDQ 2(2),357,78
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Endocrine system
EFFECTS ON NEWBORN

orl-mus TDLo:152 mg/kg (1-19D preg) TXAPA9 62,402,82
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Immune and reticuloendothelial system

orl-mus TDLo:7 mg/kg (15-21D preg) BJPCBM 49,311,73
EFFECTS ON NEWBORN
Behavioral

orl-mus TDLo:3040 ug/kg (1-19D preg) ENVRAL 35,204,84
EFFECTS ON NEWBORN

unr-mus TDLo:168 mg/kg (1-21D preg) APTOD9 19,A18,80
EFFECTS ON NEWBORN

Delayed effects

California Prop 65: Carcinogen (07/01/88)
No significant risk level .5 ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Chlordane; CASRN 57-74-9 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Chlordane
CASRN -- 57-74-9
Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Sufficient evidence in studies in which benign and malignant liver tumors were induced in four strains of mice of both sexes and in F344 male rats; structurally related to other liver carcinogens

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. There were 11 case reports involving central nervous system effects, blood dyscrasias and neuroblastomas in children with pre-/postnatal exposure to chlordane and heptachlor (Infante et al., 1978). As no other information was available, no conclusions can be drawn.

There were three epidemiologic studies of workers exposed to chlordane and/or heptachlor. One study of pesticide applicators was considered inadequate in sample size and duration of follow-up. This study showed marginal statistically significant increased mortality from bladder cancer (3 observed) (Wang and McMahon, 1979a). The other two studies were of pesticide manufacturing workers. Neither of them showed any statistically significantly increased cancer mortality (Wang and McMahon, 1979b; Ditraglia et al., 1981). Both these populations also had confounding exposures from other chemicals.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Chlordane has been studied in four mouse and four rat long-term carcinogenesis bioassays. Dose-related incidences of liver carcinoma constitute the major finding in mice. Becker and Sell (1979) tested chlordane (90:10 mixture of chlordane to heptachlor) in C57B1/6N mice, a strain historically known not to develop spontaneous liver tumors. An unspecified number of mice were fed chlordane at 0, 25 and 50 ppm (0, 3.57, 7.14 mg/kg bw) for 18 months. None of the controls developed tumors or nodular lesions of the liver. Twenty-seven percent (16 mice) of the surviving treated mice developed primary hepatocellular carcinomas. Velsicol (1973) fed groups of 100 male and 100 female CD-1 mice diets with 0, 5, 25 or 50 ppm analytical grade chlordane for 18 months. A significant ($p<0.01$) dose-related increase in nodular hyperplasias in the liver of male and female mice was reported at the the two highest dose levels. A histological review by Reuber (U.S. EPA, 1985) reported a high incidence ($p<0.01$) of hepatic carcinomas instead of hyperplastic nodules at 25 and 50 ppm.

A dose-related increase ($p<0.001$ after lifetable adjustment) of hepatocellular carcinomas was also observed in both sexes of B6C3F1 mice (NCI, 1977). Male and female mice were fed technical-grade chlordane (purity\= 94.8%) at TWA concentrations (TWAC) of 29.9 and 56.2 ppm and 30.1 and 63.8 ppm, respectively, for 80 weeks. In this study there were individual matched controls for the low and high dose groups. ICR male mice developed hepatocellular adenomas and hemangiomas when fed 12.5 ppm chlordane for 24 months. No tumors were observed in the female mice when tested at the same concentrations: 0, 1, 5, and 12.5 ppm (Velsicol, 1983a).

Velsicol (1983b) reported a long-term (130 weeks) carcinogenesis bioassay on 80 male and 80 female F344 rats fed concentrations of 0, 1, 5, and 25 ppm chlordane. A significant increase in adenomas of the liver was observed in male rats receiving 25 ppm. Although no tumors were observed in female rats, hepatocellular swelling was significantly increased at 25 ppm. The NCI (1977) reported a significant increase ($p<0.05$) of neoplastic nodules of the liver in low-dose Osborne-Mendel female rats (TWAC of 120.8 ppm) but not in the high-dose group (TWAC of 241.5 ppm). No tumor incidence was reported for the males fed TWAC of 203.5 and 407 ppm. Loss of body weight and a dose-related increase in mortality was observed in all treated groups. High mortality and reduced growth rates in Osborne-Mendel rats was also observed by Ingle (1952) when the rats were exposed to 150 and 300 ppm chlordane but not at 5, 10, and 30 ppm. No treatment-related incidence of tumors was reported. Significantly enlarged livers and liver lesions were found in male and female albino rats fed chlordane at greater than or equal to 80 ppm (Ambrose et al., 1953a,b). No treatment-related increase in tumors was found, but the study duration (400 days) was short.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Gene mutation assays indicate that chlordane is not mutagenic in bacteria (Wildeman and Nazar, 1982; Probst et al., 1981; Gentile et al., 1982). Positive results have been reported in Chinese hamster lung V79 cells and mouse lymphoma L5178Y cells with and without exogenous metabolism, as well as in plant assays. Chlordane did not induce DNA repair in bacteria, rodent hepatocytes (Maslansky and Williams, 1981), or human lymphoid cells (Sobti et al., 1983). It is a genotoxicant in yeast (Gentile et al., 1982; Chambers and Dutta, 1976), human fibroblasts (Ahmed et al., 1977), and fish (Vigfusson et al., 1983).

Five compounds structurally related to chlordane (aldrin, dieldrin, heptachlor, heptachlor epoxide, and chlorendic acid) have produced liver tumors in mice. Chlorendic acid has also produced liver tumors in rats.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 1.3E+0 per (mg/kg)/day

Drinking Water Unit Risk -- 3.7E-5 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	3E+0 ug/L
E-5 (1 in 100,000)	3E-1 ug/L
E-6 (1 in 1,000,000)	3E-2 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hepatocellular carcinoma
Test Animals -- mouse/CD-1 (Velsicol); mouse/B6C3F1 (NCI)
Route -- diet
Reference -- Velsicol, 1973; NCI, 1977

Administered Human Equivalent Tumor

Dose (ppm)	Dose (mg/kg-day)	Incidence	Reference
female			
0	0.000	0/45	Velsicol, 1973
5	0.052	0/61	
25	0.260	32/50	
50	0.520	26/37	
male			
0	0.000	3/33	Velsicol, 1973
5	0.052	5/55	
25	0.260	41/52	
50	0.520	32/39	
male			
0	0.00	2/18	NCI, 1977
29.9	0.31	16/48	
56.2	0.58	43/49	
female			
0	0.00	0/19	NCI, 1977
30.1	0.31	3/47	
63.8	0.66	34/49	

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Four data sets for mice and one data set for rats showed a significant increase in liver tumors; namely hepatocellular carcinomas in mice (NCI, 1977; Velsicol, 1973) and hepatocellular adenomas in rats (Velsicol, 1983a). The quantitative estimate is based on the geometric mean from the four mouse data sets as mice were the more sensitive species tested and as risk estimates for a similar compound (heptachlor) were similarly derived from mouse tumor data. The slope factors for the data sets are these: 2.98 per (mg/kg)/day for CD-1 female mice, 4.74 per (mg/kg)/day for CD-1 male mice, 0.76 per (mg/kg)/day for B6C3F1 male mice, and 0.25 per (mg/kg)/day for B6C3F1 female mice. Low and high dose groups in the NCI (1977) study had individual matched controls.

The unit risk should not be used if the water concentration exceeds 300 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Liver carcinomas were induced in mice of both sexes in two studies. An adequate number of animals was observed, and dose-response effects were reported in all studies. The geometric mean of slope factors (0.25 to 4.74 per (mg/kg)/day for the most sensitive species is consistent with that derived from rat data (1.11/mg/kg/day).

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 3.7E-4 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	3E-1 ug/cu.m
E-5 (1 in 100,000)	3E-2 ug/cu.m
E-6 (1 in 1,000,000)	3E-3 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

The inhalation risk estimates were calculated from the oral data presented in II.B.2.

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if the air concentration exceeds 30 ug/cu.m, above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

See II.B.4.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1986. Carcinogenicity Assessment of Chlordane and Heptachlor/ Heptachlor Epoxide. Prepared by the Office of Health and Environmental Assessment, Carcinogen Assessment Group, Washington, DC.

U.S. EPA. 1985. Hearing Files on Chlordane, Heptachlor Suspension (unpublished draft). Available for inspection at U.S. EPA, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The values in the 1986 Carcinogenicity Assessment for Chlordane and Heptachlor/Heptachlor Epoxide have been reviewed by the Carcinogen Assessment Group.

Agency Work Group Review: 04/01/87

Verification Date: 04/01/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm V. Singh / ORD -- (202)260-5958 / FTS 260-5958

Jim Cogliano / ORD -- (202)260-9243 / FTS 260-9243

Carcinogen Assessment
Group.

Agency Work Group Review: 04/01/87

Verification Date: 04/01/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm V. Singh / ORD -- (202)260-5958 / FTS 260-5958

Jim Cogliano / ORD -- (202)260-9243 / FTS 260-9243

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
respirator for sprays, fogs or dust; goggles; rubber gloves.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Any possibility of skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Immediately when skin becomes contaminated.

** WORK CLOTHING SHOULD BE CHANGED DAILY:
If there is any possibility that the clothing may be contaminated.

** REMOVE CLOTHING:
Immediately remove non-impervious clothing that becomes contaminated.

** THE FOLLOWING EQUIPMENT SHOULD BE MADE AVAILABLE:
Eyewash,quick drench.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (CHLORDANE)
5 mg/M3: Any chemical cartridge respirator with organic vapor cartridge(s) in combination with a dust, mist and fume filter. / Any supplied-air respirator. / Any self-contained breathing apparatus.
12.5 mg/M3: Any supplied-air respirator operated in a continuous flow mode. / Any powered air-purifying respirator with organic vapor cartridge(s) in combination with a dust, mist, and fume filter.
25 mg/M3: Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece. / Any powered air-purifying respirator with a tight-fitting facepiece and organic vapor cartridge(s) in combination with a high-efficiency particulate filter. / Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any air-purifying respirator with a high-efficiency particulate filter.
500 mg/M3: Any supplied-air respirator with a half-mask and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: administer oxgen and give fluid therapy; do not give epinephrine, since it may induce ventricular fibrillation; enforce complete rest.
EYES: flush with water for at least 15 min.
SKIN: wash off skin with adequate quantities of soap and water; do NOT scrub.
INGESTION: induce vomiting and follow with gastric lavage and

administration of saline cathartics; ether and barbiturates may be used to control convulsions; oxygen and fluid therapy are also recommended; do NOT give epinephrine. Since no specific antidotes are known, symptomatic therapy must be accompanied by complete rest.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Dry chemical, foam, carbon dioxide. Note: Water may be ineffective on solution fire. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: ORGANOCHLORINE PESTICIDES SOLID TOXIC, N.O.S.
DOT ID NUMBER: UN2761

ERG93 GUIDE 55

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous; may be fatal if inhaled, swallowed or absorbed through skin.
Contact may cause burns to skin and eyes.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.
Fire may produce irritating or poisonous gases.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Container may explode violently in heat of fire.
Material may be transported in a molten form.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and chemical protective clothing which is specifically recommended by the shipper or manufacturer may be worn. It may provide little or no thermal protection.
*Structural firefighters' protective clothing is not effective for these materials. See the Table of Initial Isolation and Protective Action Distances. If you find the ID Number and the name of the material there, begin protective action. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300.
*FIRE
Small Fires: Dry chemical, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Fight fire from maximum distance. Stay away from ends of tanks.
Dike fire control water for later disposal; do not scatter the material.
*SPILL OR LEAK
Do not touch or walk through spilled material; stop leak if you can do it without risk. Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Use water spray to reduce vapors.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

CHEMTOX DATA

------------------------------- IDENTIFIERS ----------------------------------

CHEMTOX RECORD 179   LAST UPDATE OF THIS RECORD: 03/09/95

NAME: DIELDRIN

SYNONYMS: ALVIT; COMPOUND 497; DIELDREX; DIELDRIN; DIELDRIN (DOT);
DIELDRINE (French); DIELDRITE; ENT 16,225; HEOD;
HEXACHLOROEPOXYOCTAHYDRO-endo,exo-DIMETHANONAPHTHALENE;
ILLOXOL; NCI-C00124; OCTALOX; PANORAM D-31; QUINTOX;
1,2,3,4,10,10-HEXACHLORO-6,7-EPOXY-1,4,4A,5,6,7,8,8A-OCTAHYDRO-1,4-ENDO-EXO-5,8-DI-METHANONAPHTHALEN
3,4,5,6,9,9-HEXACHLORO-1a,2,2a,3,6,6a,7,7a-OCTAHYDRO-2,7:3,6-DIMETHANO;
DIELDRIN
(HEXACHLOROEPOXYOCTAHYDRO-ENDO,EXO-DIMETHANONAPHTHALENE
85% AND RELATED COMPOUNDS 15%);
HEXACHLOROEPOXYOCTAHYDRO-ENDO,EXO-DIMETHANONAPHTHALENE 85%
AND RELATED COMPOUNDS 15% = DIELDRIN; ENT-16225; SD 3417;
D-31

CAS: 60-57-1   RTECS: IO1750000

FORMULA: C12H8Cl6O   MOL WT: 380.91

WLN: T E3 D5 C555 A D- FO KUTJ AG AG BG JG KG LG ENDO EXO

CHEMICAL CLASS: Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ----------------------------------

PHYSICAL DESCRIPTION: white crystals or light brown flakes with a mild chemtical odor. may be dissolved in petroleum based solvent. (nydh) [insecticide]

BOILING POINT:	dec		dec
MELTING POINT:	447.51 K	174.3 C	345.8 F
FLASH POINT:	Not available		
AUTO IGNITION:	Not available		
VAPOR PRESSURE:	1.8X10-7		
UEL:	Not applicable		
LEL:	Not applicable		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	1.75 20C		
DENSITY:	1.75 g/cc or 16.275 lb/gal		
WATER SOLUBILITY:	0.02 %		
INCOMPATIBILITIES:	strong ox,active metals like sodium,strong acids,phenols		

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors

ODOR DETECTED AT (ppm):	0.041 ppm
ODOR DESCRIPTION:	Mild chemical Source:CHRIS
100 % ODOR DETECTION:	No data

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	6.1 POISON
DOT guide:	55
Identification number:	NA2761
DOT shipping name:	Dieldrin
Packing group:	II
Label(s) required:	POISON
Special provisions:	
Packaging exceptions:	173.None
Non bulk packaging:	173.212
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	0.5 kg
Cargo aircraft only:	5 kg
Vessel stowage:	A
Other stowage provisions:	40

STCC NUMBER: 4941134, 4941135, 4941133

CLEAN WATER ACT Sect.307:	Yes
CLEAN WATER ACT Sect.311:	Yes
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	P037
CERCLA REF:	Y
RQ DESIGNATION:	X 1 pound (0.454 kg) CERCLA
SARA TPQ VALUE:	Not listed

SARA Sect. 312
categories:

Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
Chronic toxicity: reproductive toxin.
Acute toxicity: Highly toxic. LD50 is 50 mg/kg or less (oral rat).
Chronic toxicity: carcinogen

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	ORM-A
Mailability:	Domestic service and air transportation; shipper's declaration required
Max per parcel:	70 LBS; 5 LBS

NFPA CODES:

HEALTH HAZARD (BLUE):	Unspecified
FLAMMABILITY (RED) :	Unspecified
REACTIVITY (YELLOW):	Unspecified
SPECIAL :	Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS**
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Department of Health Services Drinking Water Action List.
Clean Water Act Section 307 Priority Pollutants
Clean Water Act Section 311 Hazardous Chemicals List.
DIELDRIN [60-57-1]
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
First Third Wastes List. 40 CFR 268.10. 54 FR 26594 (June 23, 1989)
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 110 Priority List of CERCLA Hazardous Substances
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

---------------------------- TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: INHALATION: may cause nausea, drowsiness, loss of appetite, visual disturbances and insomnia. sprays of 1 to 2 1/2% have caused giddiness, headache, muscle twitching, convulsions and loss of consciousness. SKIN: can be absorbed to cause or increase the severity of symptoms as listed under ingestion. Eyes: can cause irritation and redness. INGESTION: may cause headache, nausea, insomnia, high blood pressure, vision problems, loss of coordination, profuse sweating, dizziness, frothing at the mouth, convulsions and loss of consciousness. death may occur from as little at 1/20 ounce (1.4 gram). some symptoms may be delayed up to 12 hours.(NYDH)

LONG TERM TOXICITY: workplace related exposure has caused dizziness, nausea, muscle twitch, convulsions, enlarged liver and skin irritation. dieldrin has caused cancer in laboratory animals. it is considered a suspect occupational carcinogen.(NYDH)

TARGET ORGANS:

SYMPTOMS:	Inhalation, ingestion, or skin contact causes irritability, convulsions and/or coma, nausea, vomiting, headache, fainting, tremors. Contact with eyes causes irritation. Source: CHRIS
CONC IDLH:	50mg/m3
NIOSH REL:	Potential occupational carcinogen --LOWEST FEASIBLE
ACGIH TLV:	TLV = 0.25mg/M3 SKIN
ACGIH STEL:	Not listed
OSHA PEL:	Transitional Limits: PEL = 0.25mg/M3(SKIN) Final Rule Limits: TWA = 0.25 mg/M3(SKIN)
MAK INFORMATION:	0.25 calculated as total dust mG/M3 Substance with systemic effects, onset of effect over 2 hours: Peak = 10xMAK for 30 minutes, once per shift of 8 hours. Danger of cutaneous absorption
CARCINOGEN?:	N STATUS: See below
REFERENCES:	
	ANIMAL POSITIVE IARC** 5,125,74 HUMAN INDEFINITE IARC** 5,125,74

CARCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

* orl-man LDLo:65 mg/kg 34ZIAG -,215,69

LD50 value: orl-rat LD50:38300 ug/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:38300 ug/kg
ihl-rat LC50:13 mg/m3/4H
skn-rat LD50:56 mg/kg
ipr-rat LD50:35 mg/kg
scu-rat LD50:49 mg/kg
ivn-rat LD50:9 mg/kg

orl-mus LD50:38 mg/kg
ipr-mus LDLo:26 mg/kg
ivn-mus LD50:10500 ug/kg
orl-dog LD50:65 mg/kg
unr-dog LDLo:65 mg/kg
orl-mky LD50:3 mg/kg
orl-cat LDLo:500 mg/kg
ihl-cat LC50:80 mg/m3/4H
skn-cat LDLo:750 mg/kg
orl-rbt LD50:45 mg/kg
skn-rbt LD50:250 mg/kg
scu-rbt LDLo:150 mg/kg
orl-pig LD50:38 mg/kg
orl-gpg LD50:49 mg/kg
orl-ham LD50:60 mg/kg
orl-pgn LD50:23700 ug/kg
ivn-pgn LD50:1200 mg/kg
orl-ckn LD50:20 mg/kg
orl-qal LD50:10780 ug/kg
orl-dck LD50:381 mg/kg
unr-mam LD50:25 mg/kg
orl-bwd LD50:13300 ug/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:14 ug/kg (multigenerations) PCBPBS 13,20,80
EFFECTS ON NEWBORN
Behavioral

orl-rat TDLo:336 ug/kg (56D male) 32OAAP -,189,73
PATERNAL EFFECTS
Prostate,seminal vessel,Cowper's gland,accessory glands,urethra

orl-mus TDLo:30600 ug/kg (6-14D preg) THERAP 25,907,70
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Central nervous system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Eye,ear

orl-mus TDLo:15 mg/kg (9D preg) TJADAB 9,11,74
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)

orl-mus TDLo:2250 ug/kg (6-14D preg) TJADAB 16,57,77
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

orl-mus TDLo:12500 ug/kg (1D male) FCTXAV 13,317,75
EFFECTS ON FERTILITY
Pre-implantation mortility

orl-mus TDLo:4500 ug/kg (6-14D preg) TJADAB 16,57,77
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

orl-mus TDLo:6250 ug/kg (5D male) ENVRAL 9,26,75
PATERNAL EFFECTS
Other effects on male

orl-dog TDLo:219 mg/kg (44W pre/1-8W preg) JAVMA4 123,28,53
EFFECTS ON NEWBORN
Live birth index(# fetuses per liter)

orl-ham TDLo:30 mg/kg (8D preg) TJADAB 9,11,74
EFFECTS ON FERTILITY
Post-implantation mortality
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-ham TDLo:30 mg/kg (8D preg) TJADAB 9,11,74
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Eye,ear
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Body wall
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)

California Prop 65: Carcinogen (07/01/88)
No significant risk level .04 ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Dieldrin; CASRN 60-57-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Dieldrin
CASRN -- 60-57-1
Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a

low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Dieldrin is carcinogenic in seven strains of mice when administered orally. Dieldrin is structurally related to compounds (aldrin, chlordane, heptachlor, heptachlor epoxide, and chlorendic acid) which produce tumors in rodents.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. Two studies of workers exposed to aldrin and to dieldrin reported no increased incidence of cancer. Both studies were limited in their ability to detect an excess of cancer deaths. Van Raalte (1977) observed two cases of cancer (gastric and lymphosarcoma) among 166 pesticide manufacturing workers exposed 4-19 years and followed from 15-20 years. Exposure was not quantified, and workers were also exposed to other organochlorine pesticides (endrin and telodrin). The number of workers studied was small, the mean age of the cohort (47.7 years) was young, the number of expected deaths was not calculated, and the duration of exposure and of latency was relatively short.

In a retrospective mortality study, Ditraglia et al. (1981) reported no statistically significant excess in deaths from cancer among 1155 organochlorine pesticide manufacturing workers [31 observed vs. 37.8 expected, Standardized Mortality Ratio (SMR) = 82]. Workers were employed for 6 months or more and followed 13 years or more (24,939 person-years). Workers with no exposure (for example, office workers) were included in the cohort. Vital status was not known for 112 or 10% of the workers, and these workers were assumed to be alive; therefore additional deaths may have occurred but were not observed. Exposure was not quantified and workers were also exposed to other chemicals and pesticides (including endrin). Increased incidences of deaths from cancer were seen at several specific sites: esophagus (2 deaths observed, SMR = 235); rectum (3, SMR = 242); liver (2, SMR = 225); and lymphatic and hematopoietic system (6, SMR = 147), but these site-specific incidences were not statistically significantly increased.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Dieldrin has been shown to be carcinogenic in various strains of mice of both sexes. At different dose levels the effects range from benign liver tumors, to hepatocarcinomas with transplantation confirmation, to pulmonary metastases.

The Food and Drug Administration (FDA) conducted a long-term carcinogenesis bioassay for dieldrin (Davis and Fitzhugh, 1962). Ten ppm dieldrin was administered orally to 218 male and female C3HeB/Fe mice for 2 years. The study was compromised by the poor survival rate, lack of detailed pathology, loss of a large percentage of the animals to the study, and failure to treat the data for males and females separately. A statistically significant increase in incidence of hepatomas was observed in the treated groups versus the control groups in both males and females. In FDA follow-up study, Davis (1965) examined 100 male and 100 female C3H mice which had been orally administered 10 ppm dieldrin. The same limitations as the previous study were reported. The incidence of benign hepatomas and hepatic carcinomas was significantly increased in the dieldrin group. A reevaluation of the histological material of both studies was done by Reuber in 1974 (Epstein, 1975a,b; 1976). He concluded that the hepatomas were malignant and that dieldrin was hepatocarcinogenic for male and female C3HeB/Fe and C3H mice.

Walker et al. (1972) conducted several studies of dieldrin in CF1 mice of both sexes. Dieldrin was administered orally at concentrations of 0, 0.1, 1.0, and 10 ppm. Treatment groups varied from 87 to 288 animals of each sex. Surviving animals were sacrificed during weeks 132-140. Incidence of tumors was related to the number of dose levels and the dose administered. Effects were detected at the lowest dieldrin level tested (0.1 ppm) in both male and female mice. Dieldrin also produced significant increases (<0.05) in the incidence of pulmonary adenomas, pulmonary carcinomas, lymphoid tumors, and "other" tumors in female mice.

Diets containing 10 ppm dieldrin were fed to groups of 30 CF1 mice of both sexes for 110 weeks (Thorpe and Walker, 1973). The control group consisted of 45 mice of both sexes. A statistically significant increase (p<0.01) in incidence of liver tumors was found in both sexes of treated animals relative to controls. The liver tumors appeared much earlier in treated animals than controls.

Technical-grade dieldrin (>96%) was fed to B6C3F1 mice (50/sex/dose) at TWA doses of 0, 2.5, or 5 ppm for 80 weeks followed by an observation period of 10 to 13 weeks (NCI, 1978a). Matched control groups consisted of 20 untreated males and 10 untreated females. No significant difference in survival was noted. A significant dose-related increase in hepatocellular carcinoma was found in male mice when compared with pooled controls.

Tennekes et al. (1981) fed groups of 19 to 82 male CF1 mice control or dieldrin-supplemented (10 ppm) diets or control diets for 110 weeks. Dieldrin produced a statistically significant increased incidence of hepatocellular carcinomas in the treated group.

Dieldrin (>99%) was continuously fed in the diet for 85 weeks to 50 C3H/He, 62 B6C3F1, and 71 C57Bl/6J male mice (Meierhenry et al., 1983). Controls were 50 to 76 males of each strain. Dieldrin produced a significant increase in the incidence of hepatocellular carcinomas compared with controls in all three strains.

Seven studies with four strains of rats fed 0.1 to 285 ppm dieldrin varying in duration of exposure from 80 weeks to 31 months did not produce positive results for carcinogenicity (Treon and Cleveland, 1955; Fitzhugh et al., 1964; Song and Harville, 1964; Walker et al., 1969; Deichmann et al., 1970; NCI, 1978a,b). Three of these studies used Osborne-Mendel rats, two studies used Carworth rats, and one each used Fischer 344 and Holtzman strains. Only three of the seven studies are considered adequate in design and conduct. The others used too few animals, had unacceptably high levels of mortality, were too short in duration, and/or had inadequate pathology examination or reporting.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Dieldrin causes chromosomal aberrations in mouse cells (Markaryan, 1966; Majumdar et al., 1976) and in human lymphoblastoid cells (Trepanier et al., 1977), forward mutation in Chinese hamster V79 cells (Ahmed et al., 1977), and unscheduled DNA synthesis in rat (Probst et al., 1981) and human cells (Rocchi et al., 1980). Dieldrin did not produce responses in 13 other mutagenicity tests. Negative responses were given in assays for gene conversion in S. cerevisiae, back-mutation in S. marcesans, forward mutation (Gal Rz2 in E. coli), and forward mutation to streptomycin resistance in E. coli (Fahrig, 1974). Negative responses were produced in reverse mutation assays with six strains of S. typhimurium with or without metabolic activation (Bidwell et al., 1975; Marshall et al., 1976; Shirasu et al., 1976; Wade et al., 1979; Haworth et al., 1983). Majumdar et al. (1977), however, reported that dieldrin was mutagenic for S. typhimurium with and without metabolic activation.

Five compounds structurally related to dieldrin - aldrin, chlordane, heptachlor, heptachlor epoxide, and chlorondic acid - have induced malignant liver tumors in mice. Chlorendic acid has also induced liver tumors in rats.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 1.6E+1 per (mg/kg)/day

Drinking Water Unit Risk -- 4.6E-4 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E-1 ug/L
E-5 (1 in 100,000)	2E-2 ug/L
E-6 (1 in 1,000,000)	2E-3 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- liver carcinoma
Test Animals -- mouse
Route -- diet
Reference -- see table

Sex/Strain	Slope Factor	Reference
Male, C3H	22	Davis (1965), reevaluated by Reuber, 1974 (cited in Epstein, 1975a)
Female, C3H	25	Davis (1965), reevaluated by Reuber, 1974 (cited in Epstein, 1975a)
Male, CF1	25	Walker et al. (1972)
Female, CF1	28	Walker et al. (1972)
Male, CF1	15	Walker et al. (1972)
Female, CF1	7.1	Walker et al. (1972)
Male, CF1	55	Thorpe and Walker (1973)
Female, CF1	26	Thorpe and Walker (1973)
Male, B6C3F1	9.8	NCI (1978a,b)
Male, CF1	18	Tennekes et al. (1981)
Male, C57B1/6J	7.4	Meierhenry et al. (1983)
Male, C3H/He	8.5	Meierhenry et al. (1983)
Male, B6C3F1	11	Meierhenry et al. (1983)

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

The slope factor is the geometric mean of 13 slope factors calculated from liver carcinoma data in both sexes of several strains of mice. Inspection of the data indicated no strain or sex specificity of carcinogenic response.

The unit risk should not be used if the water concentration exceeds 20 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

The individual slope factors calculated from 13 independent data sets range within a factor of 8.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 4.6E-3 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E-2 ug/cu.m
E-5 (1 in 100,000)	2E-3 ug/cu.m
E-6 (1 in 1,000,000)	2E-4 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Calculated from oral data in Section II.B.2.

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk should not be used if air concentrations exceed 2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

This inhalation risk estimate was based on oral data.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1986. Carcinogenicity Assessment of Aldrin and Dieldrin. Prepared by Carcinogen Assessment Group, Office of Health and Environmental Assessment, Washington, DC for Hazard Evaluation Division, Office of Pesticide Programs, Office of Pesticides and Toxic Substances. OHEA-C-205.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

Agency Work Group Review: 03/05/87

Verification Date: 03/05/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm Singh /ORD -- (202)260-5958 / FTS 260-5958

James Cogliano / ORD -- (202)260-9243 / FTS 260-9243

S 260-9243

---------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
u. s. bureau mines approved respirator; clean rubber gloves; goggles or face shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Any possibility of skin contact.

** WEAR EYE PROTECTION TO PREVENT:

Any possibility of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Immediately when skin becomes contaminated.

** WORK CLOTHING SHOULD BE CHANGED DAILY:
If there is any possibility that the clothing may be contaminated.

** REMOVE CLOTHING:
Immediately remove non-impervious clothing that becomes contaminated.

** THE FOLLOWING EQUIPMENT SHOULD BE MADE AVAILABLE:
Eyewash,quick drench.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (DIELDRIN)
Greater at any detectable concentration. : Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: move to fresh air; give oxygen and artificial respiration as required.
INGESTION: induce vomiting and get medical attention.
EYES: flush with plenty of water; get medical attention.
SKIN: flush with plenty of water.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Dieldrin
DOT ID NUMBER: NA2761

POTENTIAL HAZARDS

*HEALTH HAZARDS

Poisonous; may be fatal if inhaled, swallowed or absorbed through skin.
Contact may cause burns to skin and eyes.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.
Fire may produce irritating or poisonous gases.

*FIRE OR EXPLOSION

Some of these materials may burn, but none of them ignites readily.
Container may explode violently in heat of fire.
Material may be transported in a molten form.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and chemical protective clothing which is specifically recommended by the shipper or manufacturer may be worn. It may provide little or no thermal protection.

*Structural firefighters' protective clothing is not effective for these materials. See the Table of Initial Isolation and Protective Action Distances. If you find the ID Number and the name of the material there, begin protective action. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300.

*FIRE

Small Fires: Dry chemical, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Fight fire from maximum distance. Stay away from ends of tanks.
Dike fire control water for later disposal; do not scatter the material.

*SPILL OR LEAK

Do not touch or walk through spilled material; stop leak if you can do it without risk. Fully-encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Use water spray to reduce vapors.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal. Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Speed in removing material from skin is of extreme importance. Removal of solidified molten material from skin requires medical assistance. Remove and isolate contaminated clothing and shoes at the site. Keep victim quiet and maintain normal body temperature. Effects may be delayed; keep victim under observation.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 5249 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: ETHYLENE, TETRACHLORO-

SYNONYMS: ANKILOSTIN; ANTISOL 1; CARBON BICHLORIDE; CARBON DICHLORIDE; CZTEROCHLOROETYLEN (Polish); DIDAKENE; DOW-PER; ENT 1,860; ETHENE, TETRACHLORO-; ETHYLENE TETRACHLORIDE; FEDAL-UN; NCI-C04580; NEMA; PER; PERAWIN; PERC; PERCHLOORETHYLEEN, PER (Dutch); PERCHLOR; PERCHLORAETHYLEN, PER (German); PERCHLORETHYLENE; PERCHLORETHYLENE, PER (French); PERCHLOROETHYLENE; PERCLENE; PERCLOROETILENE (Italian); PERCOSOLVE; PERK; PERKLONE; PERSEC; TETLEN; TETRACAP; TETRACHLOORETHEEN (Dutch); TETRACHLORAETHEN (German); TETRACHLORETHYLENE; TETRACHLOROETHENE; TETRACHLOROETHYLENE; 1,1,2,2,-TETRACHLOROETHYLENE; TETRACHLOROETHYLENE (DOT); TETRACLOROETENE (Italian); TETRALENO; TETRALEX; TETRAVEC; TETROGUER; TETROPIL

CAS:	127-18-4	RTECS:	KX3850000
FORMULA:	C2Cl4	MOL WT:	165.82
WLN:	GYGUYGG		
CHEMICAL CLASS:	FT		

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION:	colorless liquid, chloroform-like odor.		
BOILING POINT:	394.2 K	121 C	249.8 F
MELTING POINT:	254.26 K	-18.9 C	-2.1 F
FLASH POINT:	Not available		
AUTO IGNITION:	Not available		
VAPOR PRESSURE:	15.8MM @ 22C		
UEL:	~		
LEL:	~		
IONIZATION POTENTIAL (eV):	9.32		
VAPOR DENSITY:	No data		
EVAPORATION RATE:	2.59(n-BUTYL ACETATE=1)		
SPECIFIC GRAVITY:	1.625 @20/4C		
DENSITY:	1.6311 @ 15/4C		
WATER SOLUBILITY:	0.02 % IN H2O; MISCIBLE WITH MOST ORGANIC SOLVENTS AND OILS		
INCOMPATIBILITIES:	strong oxidizers, chemically active metals, such as barium, lithium, beryllium, sodium		
REACTIVITY WITH WATER:	No data on water reactivity		
REACTIVITY WITH COMMON MATERIALS:	No data		
STABILITY DURING TRANSPORT:	No Data		

NEUTRALIZING AGENTS: No data
POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: HCL AND PHOSGENE\CORROSIVE
ODOR DETECTED AT (ppm): 5 ppm
ODOR DESCRIPTION: mildly sweet Source:CHRIS
100 % ODOR DETECTION: No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class: 6.1 POISON
DOT guide: 74
Identification number: UN1897
DOT shipping name: Tetrachloroethylene
Packing group: III
Label(s) required: KEEP AWAY FROM FOOD
Special provisions: N36,T1
Packaging exceptions: 173.153
Non bulk packaging: 173.203
Bulk packaging: 173.241
Quantity limitations-
Passenger air/rail: 60 L
Cargo aircraft only: 220 L
Vessel stowage: A
Other stowage provisions:40

STCC NUMBER: 4940355

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.005 mg/L (07/30/92)
Maximum Contaminant Level Goals (MCLG): 0 mg/L (07/30/92)
CLEAN AIR ACT: CAA '90 Listed
EPA WASTE NUMBER: U210,D039
CERCLA REF: Y
RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: carcinogen
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class: ORM-A
Mailability: Domestic service and air transportation; shipper's declaration required
Max per parcel: 10 GAL; 1 PT

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (0) This material does not readily burn.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Hazardous Materials Table. 49 CFR 172.101
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA 8(d) Health and Safety Data Rule - effective date 06/01/87
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
ETHYLENE, TETRACHLORO- [127-18-4]
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: exposures of 200 ppm for 1 hour can cause irritation of the nose, mouth and throat, dizziness, headaches and lightheadedness; exposures of 1,000 ppm for 30 minutes can cause difficult breathing, weakness, loss of muscle control, irritability, tremors, convulsions, paralysis, coma, heart irregularities and death. SKIN: can cause dry, scaly skin, a mild to moderate burning sensation, redness and inflammation. Eyes: can cause burning and irritation. INGESTION: can cause nausea, vomiting, diarrhea, bloody stool, a reddening of face and neck, weakness and loss of muscle control.(NYDH)

LONG TERM TOXICITY: exposures over 200 ppm during weeks or months can cause irritation of the respiratory tract, nausea, headache, sleeplessness, abdominal pains, constipation, dizziness, increased perspiration, fatigue, skin infection, kidney and liver damage, fluid in the lungs and coma. most of these effects will disappear after exposure is stopped. tetrachloroethylene at high levels has caused cancer and birth defects in mice. whether it causes cancer in humans is unknown.(NYDH)

TARGET ORGANS: skin, mucous membrane, eyes, CNS, gastrointestinal tract. liver, kidneys.

SYMPTOMS: Vapor can affect central nervous system and cause anesthesia. Liquid may irritate skin after prolonged contact. May irritate eyes but causes no injury. Source: CHRIS

CONC IDLH: 150ppm

NIOSH REL: Potential occupational carcinogen --MINIMIZE EXPOSURE (Limit of quantitation 0.4 ppm)

ACGIH TLV: TLV = 25ppm(170 mg/M3) A3
ACGIH STEL: STEL = 100 ppm(685 mg/M3)»A3

OSHA PEL: Transitional Limits:
PEL = 100 PPM; CEILING = 200 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 2 HOURS = 300
Final Rule Limits:
TWA = 25 ppm (170 mg/M3)

MAK INFORMATION: 50 ppm
345 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.
There is no reason to fear a risk of damage to the developing embryo or fetus when MAK values are adhered to.
A compound which is justifiably suspected of having

carcinogenic potential.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.

MAK: A compound which is justifiably suspected of having carcinogenic potential.

NIOSH: Carcinogen defined by NIOSH with no further categorization.

NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.

ACGIH: Animal carcinogen. The chemical is carcinogenic in experimental animals at a relatively high dose, by routes or administration, at sites, or histological types, or by mechanisms that are not considered relevant to worker exposure.

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-hmn TCLo:96 ppm/7H NTIS** PB257-185
PERIPHERAL NERVE AND SENSATION
Local anesthetic
SENSE ORGANS
Eye
Conjunctive irritation
BEHAVIORAL
Hallucinations, distorted perceptions

orl-chd TDLo:545 mg/kg JTCTDW 23,103,85
BEHAVIORAL
Coma

LD50 value: orl-rat LD50:2629 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:2629 mg/kg
ihl-rat LC50:34200 mg/m3/8H
ipr-rat LD50:4678 mg/kg
orl-mus LD50:8100 mg/kg
ihl-mus LC50:5200 ppm/4H
scu-mus LD50:65 gm/kg

orl-dog LDLo:4 gm/kg
ipr-dog LD50:2100 mg/kg
ivn-dog LDLo:85 mg/kg
orl-cat LDLo:4 gm/kg
orl-rbt LDLo:5 gm/kg
scu-rbt LDLo:2200 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 810 mg/24H SEV
eye-rbt 162 mg MLD

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:1000 ppm/24H (14D pre/1-22D preg) APTOD9 19,A21,80
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rat TCLo:1000 ppm/24H (1-22D preg) APTOD9 19,A21,80
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:900 ppm/7H (7-13D preg) TJADAB 19,41A,79
EFFECTS ON NEWBORN
Live birth index(# fetuses per liter)
EFFECTS ON NEWBORN

EFFECTS ON NEWBORN
Behavioral

ihl-rat TCLo:300 ppm/7H (6-15D preg) TXAPA9 32,84,75
EFFECTS ON FERTILITY
Post-implantation mortality

ihl-mus TCLo:300 ppm/7H (6-15D preg) TXAPA9 32,84,75
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Homeostatis

California Prop 65: Carcinogen (04/01/88)
No significant risk level 14. ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Tetrachloroethylene; CASRN 127-18-4 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Tetrachloroethylene

This substance/agent has been evaluated by the U.S. EPA for evidence of human carcinogenic potential. This does not imply that this agent is necessarily a carcinogen. The evaluation for this chemical is under review by an inter-office Agency work group. A risk assessment summary will be included on IRIS when the review has been completed.

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes contaminated.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash promptly
INHALATION: art resp
INGESTION: ipecac, vomit

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if illness occurs, remove patient to fresh air, keep him warm and quiet, and get medical attention.
INGESTION: induce vomiting only on physician's recommendation.
EYES AND
SKIN: flush with plenty of water and get medical attention if irritation or injury occurs.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give

oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Tetrachloroethylene
DOT ID NUMBER: UN1897

ERG93 GUIDE 74

POTENTIAL HAZARDS

*HEALTH HAZARDS
Vapors may cause dizziness or suffocation.
Exposure in an enclosed area may be very harmful.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Most vapors heavier than air.
*Air/vapor mixtures may explode when ignited.
Container may explode in heat of fire.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical or CO2.
Large Fires: Water spray, fog or regular foam.
Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

Use first aid treatment according to the nature of the injury.

CHEMTOX DATA

------------------------------ IDENTIFIERS ------------------------------

CHEMTOX RECORD	407	LAST UPDATE OF THIS RECORD:	03/09/95
NAME:	TRICHLOROETHYLENE		
SYNONYMS:	TRICHLOROETHENE; ETHYLENE TRICHLORIDE; TRICLENE		
CAS:	79-01-6	RTECS:	KX4550000
FORMULA:	C2HCl3	MOL WT:	131
WLN:	GYGU1G		
CHEMICAL CLASS:	FT		

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ------------------------------

PHYSICAL DESCRIPTION: colorless watery liquid with a sweet, chloroform-like odor. may be dyed blue.

BOILING POINT:	359.82 K	86.6 C	188 F
MELTING POINT:	200.37 K	-72.8 C	-99.1 F
FLASH POINT:		Not available	
AUTO IGNITION:	683 K	409.8 C	769.8 F

VAPOR PRESSURE:	58 MM
UEL:	10.5 % @ 25 C
LEL:	8 % @ 25 C
IONIZATION POTENTIAL (eV):	9.47
VAPOR DENSITY:	4.5 (air=1)
EVAPORATION RATE:	6.39(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	1.46 20C
DENSITY:	1.460
WATER SOLUBILITY:	0.0001 %
INCOMPATIBILITIES:	strong caustics; when acidic reacts with aluminum; chemically active metals; barium, lithium, sodium, magnesium, titanium
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	50 ppm
ODOR DESCRIPTION:	Chloroform-like; ethereal Source:CHRIS
100 % ODOR DETECTION:	No data

------------------------------ REGULATIONS ------------------------------

DOT hazard class: 6.1 POISON

DOT guide: 74
Identification number: UN1710
DOT shipping name: Trichloroethylene
Packing group: III
Label(s) required: KEEP AWAY FROM FOOD
Special provisions: N36,T1
Packaging exceptions: 173.153
Non bulk packaging: 173.203
Bulk packaging: 173.241
Quantity limitations-
Passenger air/rail: 60 L
Cargo aircraft only: 220 L
Vessel stowage: A
Other stowage provisions:40

STCC NUMBER: 4941771

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.005 mg/L (01/09/89)
Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/09/89)
CLEAN AIR ACT: CAA '90 Listed
EPA WASTE NUMBER: U228,D040
CERCLA REF: Not listed
RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Chronic toxicity: carcinogen
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: ORM-A
Mailability: Domestic service and air transportation; shipper's declaration required
Max per parcel: 10 GAL;1 PT

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (1) This material must be preheated before ignition can occur.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/90/127523/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
TRICHLOROETHYLENE [79-01-6]
Washington State Discarded Chemical Products List, November 17, 1989
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: headache, sleepiness, nausea, vomiting, dizziness and coughing have been felt around 100 ppm. unconsciousness can result at 3,000 ppm. exposure to 8,000 ppm can cause death. SKIN: can be absorbed through skin. may cause irritation, burning or redness. Eyes: may cause irritation, burning or watering. INGESTION: can cause drunkenness, vomiting, diarrhea or abdominal pain. unconsciousness, liver or kidney damage, vision distortion and death have been reported at large doses. (NYDH)

LONG TERM TOXICITY: contact with levels near 100 ppm can casue giddiness, nervous exhaustion, increased sensitivity to alcohol including redness in the face (trichloroethylene blush), the ability to become addicted to the vapor, as well as effects of acute exposure listed above. higher levels can alter one's heart rate. repeated contact with hands can cause excessive dryness, cracking, burning, loss of sense of touch or temporary paralysis of fingers. most of these effects seem to go away after exposure has stopped. trichloroethylene is considered a cancer suspect agent because high levels cause liver cancer in mice. whether it causes cancer in humans is unknown.(NYDH)

TARGET ORGANS: eyes, skin, nose, throat, resp. system, heart, liver, kidneys, CNS.

SYMPTOMS: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation. Source: CHRIS

CONC IDLH: 1000ppm

NIOSH REL: Potential occupational carcinogen 25 ppm Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 50ppm(269 mg/M3) A5
ACGIH STEL: STEL = 100 ppm(537 mg/M3)»A5

OSHA PEL: Final Rule Limits:
TWA = 50 ppm (270 mg/M3)
STEL = 200 ppm(1080 mg/M3)

MAK INFORMATION: 50 ppm
270 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.
There is no reason to fear a risk of damage to the developing embryo or fetus when MAK values are adhered to.
A compound which is justifiably suspected of having carcinogenic potential.

CARCINOGEN?: Y STATUS: See below
REFERENCES:

ANIMAL SUSPECTED IARC** 20,545,79

ANIMAL POSITIVE IARC** 11,263,76
HUMAN INDEFINITE IARC** 20,545,79

CARCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: A compound which is justifiably suspected of having carcinogenic potential.
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Not listed
ACGIH: Not suspected as a Human Carcinogen on the basis of properly conducted epidemological sutdies in humans.
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

* orl-hmn LDLo:7 gm/kg ARTODN 35,295,76

orl-man TDLo:2143 mg/kg 34ZIAG -,602,69
GASTROINTESTINAL
Other changes

ihl-hmn TCLo:6900 mg/m3/10M AHBAAM 116,131,36
BEHAVIORAL
Somnolence(general depressed activity)
BEHAVIORAL
Hallucinations, distorted perceptions

ihl-hmn TCLo:160 ppm/83M AIHAAP 23,167,62
BEHAVIORAL
Hallucinations, distorted perceptions

ihl-hmn TDLo:812 mg/kg BMJOAE 2,689,45
BEHAVIORAL
Somnolence(general depressed activity)
GASTROINTESTINAL
Other changes
LIVER
Jaundice,other or unclassified

ihl-man TCLo:110 ppm/8H BJIMAG 28,293,71
SENSE ORGANS
Eye
Other
BEHAVIORAL
Hallucinations, distorted perceptions

LD50 value: orl-rat LD50:5650 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5650 mg/kg
ihl-rat LCLo:8000 ppm/4H
ipr-rat LD50:1282 mg/kg
orl-mus LD50:2402 mg/kg
ihl-mus LC50:8450 ppm/4H
scu-mus LD50:16 gm/kg
ivn-mus LD50:33900 ug/kg
ipr-dog LD50:1900 mg/kg
scu-dog LDLo:150 mg/kg
ivn-dog LDLo:150 mg/kg
orl-cat LDLo:5864 mg/kg
ihl-cat LCLo:32500 mg/m3/2H
orl-rbt LDLo:7330 mg/kg
ihl-rbt LCLo:11000 ppm
skn-rbt LD50:>20 gm/kg
scu-rbt LDLo:1800 mg/kg
ihl-gpg LCLo:37200 ppm/40M

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):

This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:2688 mg/kg (1-22D preg/21D post) TOXID9 4,179,84

EFFECTS ON NEWBORN

Behavioral

orl-rat TDLo:36 gm/kg (15D pre/1-21D preg) TXCYAC 32,229,84

EFFECTS ON NEWBORN

Weaning or lactation index(#alive at weaning per # alive at day 4)

orl-rat TDLo:1140 mg/kg (14D pre-21D post) BRREAP 488,403,89

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Central nervous system

ihl-rat TCLo:1800 ppm/24H (1-20D preg) APTOD9 19,A22,80

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Musculoskeletal system

SPECIFIC DEVELOPMENTAL ABNORMALITIES

Other developmental abnormalities

ihl-rat TCLo:100 ppm/4H (6-22D preg) JPHYA7 276,24P,78

EFFECTS ON FERTILITY

Post-implantation mortality

EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:1800 ppm/6H (1-20D preg) TXCYAC 14,153,79
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

ihl-rat TCLo:100 ppm/4H (8-21D preg) BJANAD 54,337,82
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-mus TCLo:100 ppm/7H (5D male) NTIS** PB82-185075
PATERNAL EFFECTS
Spermatogenisis

California Prop 65: Carcinogen (04/01/88)

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes wet.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (TRICHLOROETHYLENE)
Greater at any detectable concentration. : Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: irr immed

SKIN: soap wash promptly
INHALATION: art resp
INGESTION: ipecac, vomit

FIRST AID SOURCE: CHRIS Manual 1991
Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure.
INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen.
INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water.
EYES: flush thoroughly with water.
SKIN: wash thoroughly with soap and warm water.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

---------------------------- INITIAL INCIDENT RESPONSE -----------------------

FIRE EXTINGUISHMENT: Water fog. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Trichloroethylene
DOT ID NUMBER: UN1710

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POTENTIAL HAZARDS

*HEALTH HAZARDS
Vapors may cause dizziness or suffocation.
Exposure in an enclosed area may be very harmful.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Most vapors heavier than air.
*Air/vapor mixtures may explode when ignited.
Container may explode in heat of fire.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical or CO2.

Large Fires: Water spray, fog or regular foam.

Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.

Stop leak if you can do it without risk.

Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.

Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

CHEMTOX DATA

------------------------------ IDENTIFIERS ---------------------------------

CHEMTOX RECORD 166 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: 1,1-DICHLOROETHYLENE

SYNONYMS: CHLORURE DE VINYLIDENE (French); 1,1-DCE; 1,1-DICHLOROETHENE (9CI); 1,1-DICHLOROETHYLENE; ETHENE, 1,1-DICHLORO-; NCI-C54262; SCONATEX; VDC; VINYLIDENE CHLORIDE (II); VINYLIDENE DICHLORIDE; VINYLIDINE CHLORIDE; asym-DICHLOROETHYLENE; VINYLIDENE CHLORIDEE

CAS: 75-35-4 RTECS: KV9275000

FORMULA: C2H2Cl2 MOL WT: 96.94

WLN: GYGU1

CHEMICAL CLASS: Olefin; Halogenated h-carbon

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless, volatile, watery liquid (or gas above 89 f) with a sweet odor resembling that of chloroform

BOILING POINT:	304.82 K	31.6 C	89 F
MELTING POINT:	151 K	-122.2 C	-187.9 F
FLASH POINT:	255.37 K	-17.78 C	-.1 F
AUTO IGNITION:	808 K	534.8 C	994.8 F

VAPOR PRESSURE:	500 mm Hg @ 20 C
UEL:	16 %
LEL:	7.3 %
IONIZATION POTENTIAL (eV):	10.00
VAPOR DENSITY:	3.3 (air=1)
EVAPORATION RATE:	15.70(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	1.21 20C
DENSITY:	1.21 g/mL @ 20 C
WATER SOLUBILITY:	PRACTICALLY INSOLUBLE (0.04 %)
INCOMPATIBILITIES:	strong oxidizers, air, chlorotri-fluoroethylene; ozone; perchloryl fluoride
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	COPPER AND ALUMINUM CAN CAUSE POLYMERIZATION.
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	CAN OCCUR IF EXPOSED TO SUNLIGHT, AIR, COPPER, ALUMINUM, HEAT.
TOXIC FIRE GASES:	HCL\CORROSIVE
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	SWEET; LIKE CARBON TETRACHLORIDE OR CHLOROFORM Source:CHRIS

100 % ODOR DETECTION: No data

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1303
DOT shipping name:	Vinylidene chloride, inhibited
Packing group:	I
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T23,T29
Packaging exceptions:	173.150
Non bulk packaging:	173.201
Bulk packaging:	173.243
Quantity limitations-	
Passenger air/rail:	1 L
Cargo aircraft only:	30 L
Vessel stowage:	E
Other stowage provisions:	40

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.007 mg/L (01/09/89)
Maximum Contaminant Level Goals (MCLG): 0.007 mg/L (01/09/89)

CLEAN AIR ACT:	CAA '90 Listed
CLEAN AIR ACT Sect 112	Flam TQ=10000
EPA WASTE NUMBER:	U078,D029,D001
CERCLA REF:	Y
RQ DESIGNATION:	B 100 pounds (45.4 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Acute toxicity: adverse effect to target organs. Chronic toxicity: carcinogen Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin. Reactive hazard: unstable/reactive. Fire hazard: flammable. Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (4) This material forms readily ignitable mixtures in air.
REACTIVITY (YELLOW): (2) Normally unstable and readily undergoes violent change, but does not detonate.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

1,1-DICHLOROETHYLENE [75-35-4]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS**
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act Section 112(r) Accidental Release List -Flammables:TQ = 10000 lbs
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Hazardous Materials Table. 49 CFR 172.101
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: possible risks of long term effects. ** source: hcl3

TARGET ORGANS: resp sys, eyes, CNS

SYMPTOMS: Vapor can cause dizziness and drunkenness; high levels cause anesthesia. Liquid irritates eyes and skin. Source: CHRIS

CONC IDLH: Nonegiven

NIOSH REL: Potential occupational carcinogen (Limit of quantitation 0.4 ppm) (use 1910.1017) VINYL CHLORIDE

ACGIH TLV: TLV = 5ppm
ACGIH STEL: STEL = 20 ppm

OSHA PEL: Final Rule Limits:
TWA = 1 ppm (4 mg/M3)

MAK INFORMATION: 2 ppm
8 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.
There is no reason to fear a risk of damage to the developing embryo or fetus when MAK values are adhered to.
A compound which is justifiably suspected of having carcinogenic potential.

CARCINOGEN?: Y STATUS: See below
REFERENCES:
ANIMAL POSITIVE IARC** 19,439,79
HUMAN INDEFINITE IARC** 19,439,79

CARCINOGEN LISTS:
IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: A compound which is justifiably suspected of having carcinogenic potential.
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
ihl-hmn TCLo:25 ppm CHINAG (11),463,76
BEHAVIORAL
General anesthetic

LIVER
Other changes
KIDNEY,URETER,BLADDER
Other changes

LD50 value: orl-rat LD50:200 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:200 mg/kg
ihl-rat LC50:6350 ppm/4H
orl-mus LD50:194 mg/kg
orl-dog LDLo:5750 mg/kg
ivn-dog LDLo:225 mg/kg
scu-rbt LDLo:3700 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:200 mg/kg (6-15D preg) TXAPA9 49,189,79
EFFECTS ON FERTILITY
Other measures of fertility
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:80 ppm/7H (6-15D preg) TXAPA9 49,189,79
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rat TCLo:55 ppm/6H (55D pre) JTEHD6 3,965,77
EFFECTS ON FERTILITY
Female fertility index

California Prop 65: Not listed

----------------------------- EPA's IRIS DATA SUMMARY -------------------------
1,1-Dichloroethylene; CASRN 75-35-4 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- 1,1-Dichloroethylene
CASRN -- 75-35-4
Primary Synonym -- Vinylidene Chloride
Last Revised -- 02/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure.

The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- C; possible human carcinogen

Basis -- Tumors observed in one mouse strain after inhalation exposure is the basis for this classification. Other studies were of inadequate design. Vinylidene chloride is mutagenic, and a metabolite is known to alkylate and to bind covalently to DNA. It is structurally related to the known human carcinogen, vinyl chloride.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. An epidemiologic study of 138 workers showed no carcinogenic effect associated with vinylidene chloride exposure (Ott et al., 1976). Based on power considerations, this study is inadequate for assessing cancer risk in humans.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Limited. Eighteen animal studies have been reported, which provide information about the carcinogenic potential of vinylidene chloride. Eleven of the studies involved inhalation exposure, five were oral, and one each was by skin application and subcutaneous injection. Most were not designed for maximum sensitivity to detect carcinogenic effects. None of the 11 inhalation exposures were for lifetime; all were 12 months or less. Three of the five oral studies were of lifetime exposures. Of all the studies, only one inhalation study produced a response as a complete carcinogen.

In the inhalation study by Maltoni et al. (1985) both sexes of Swiss mice were exposed to 10 and 25 ppm (MTD) for 4-5 days/week for 12 months. A statistically significant increase in kidney adenocarcinoma was noted in male mice. Although statistically significant increases in mammary carcinomas in female mice and pulmonary adenomas in both sexes were reported, dose-response relationships were unclear. A second Maltoni study exposed Sprague-Dawley rats to 10, 25, 50, 100, or 150 ppm, 4-5 days/week for 12 months and observed them until spontaneous death. A statistically significant increase in total mammary tumors, but not carcinomas alone, was seen only at 10 and 100 ppm. No dose-response relationship was apparent, and the overall interpretation of the mammary tumor incidence is inconclusive.

Four gavage studies (in rats and mice) and one drinking water study in rats have been negative (Maltoni et al., 1985; Quast et al., 1983; Humiston et al., 1978; NTP, 1982; Ponomarkov and Tomatis, 1980). Only the NTP (1982) corn oil gavage study in Fischer 344 rats and female B6C3F1 mice and the drinking water study in Sprague-Dawley rats were undertaken for 2 years dosing. The NTP study was apparently not conducted at the MTD and the drinking water study did not achieve a maximum dose of metabolite. All other oral studies were limited in design and, thus, lacking in sensitivity sufficient to detect a response.

Vinylidene chloride did not act as a complete carcinogen when applied topically or s.c. to ICR/Ha mice but did serve as an initiator when followed by phorbol myristate acetate treatment (Van Duuren et al., 1979).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Vinylidene chloride has been shown to be mutagenic for Salmonella typhimurium in multiple assays. This activity is largely dependent on the presence of microsomal enzymes. It has been used as a positive control in studies of chemicals that are gases at or near room temperature. Both conventional and host-mediated assays of Saccharomyces cerevisiae have been positive for mitotic gene conversion (Bronzetti et al., 1981). Vinylidene chloride was not mutagenic for V79 cells exposed to vapor in vitro (Drevon and Kuroki, 1979), nor did it produce chromosomal aberrations in bone marrow cells of ICR mice given single or repeated i.p. treatment in vivo (Cerna and Kypenova, 1977). CD-1 mice and Sprague-Dawley rats treated in vivo with labeled vinylidene chloride showed evidence of DNA alkylation and subsequent repair which was specific to liver and kidney. Kidney in rat and mouse had higher alkylation than liver (Reitz et al., 1980). Covalent binding of vinylidene chloride closely correlates with metabolite formation. McKenna et al. (1977) observed greater binding in kidney than liver, and greater binding in mice than in rats. Vinylidene chloride failed to induce dominant lethal mutations in mice (Anderson et al., 1977) or rats (Short et al., 1977). Vinylidene chloride is structurally related to the known carcinogen, vinyl chloride.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 6E-1 per (mg/kg)/day

Drinking Water Unit Risk -- 1.7E-5 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	6E+0 ug/L
E-5 (1 in 100,000)	6E-1 ug/L
E-6 (1 in 1,000,000)	6E-2 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- adrenal pheochromocytomas
Test Animals -- rat/F344, male
Route -- drinking water
Reference -- NTP, 1982

Administered Dose (mg/kg-day)	Human Equivalent Dose (mg/kg-day)	Tumor Incidence
0	0	6/50
0.71	0.120	5/48
3.57	0.603	13/47

Human equivalent doses were determined by adjusting the administered animal dose by the cube root of the ratio of t

The unit risk estimate chosen was derived from the highest of four slope factors calculated from two studies that d

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Animal pharmacokinetic data show that metabolite elimination is dose-dependent and saturable at inhalation concentrations of 150-200 ppm, or approximately 50 mg/kg oral ingestion. Vinylidene chloride is rapidly absorbed, has limited solubility, and is not stored in body tissues. Pharmacokinetics and metabolism data indicate that the available assays were not of adequate design. The positive Maltoni inhalation study comes closest to achieving a maximum dose of metabolite, albeit less than lifetime exposure, but less than maximum dosing vis-a-vis metabolites. The water unit risk based on incidence data from a drinking water study was chosen because route of administration is appropriate to oral risk estimation.

The unit risk should not be used if the water concentration exceeds 6E+2 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

The estimate is based on a data set in which there is no significant increase in tumor incidence. The confidence that the upper limit is not greater than 0.6 per (mg/kg)/day is high, since it is the largest value by a factor of 3 from four rat data sets in two studies. If drinking water exposure alone is considered the estimates might be reduced by a factor of 3.

The slope factors for the oral quantitative estimate based on data from inhalation exposure and based on the negative oral data are within a factor of 2.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 5.0E-5 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E+0 ug/cu.m
E-5 (1 in 100,000)	2E-1 ug/cu.m
E-6 (1 in 1,000,000)	2E-2 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- kidney adenocarcinoma
Test Animals -- Mouse/Swiss, male
Route -- inhalation
Reference -- Maltoni et al., 1977, 1985

Dose		Tumor
Administered (ppm)	Human Equivalent (mg/kg/day)	Incidence
0	0	0/56
0	0	0/70
10	0.078	0/25
25	0.195	3/21
25	0.195	25/98

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

Within each same dose pair there were no statistically significant differences between incidences in the two control and the 25 ppm groups. These groups were combined for modeling. The number of animals surviving to appearance of the first kidney adenocarcinoma was used as the denominator for incidence. Human equivalent doses were determined assuming 0.035 kg as the average weight of the male mice, adjusting for continuous lifetime exposure in the mice, accounting for metabolism and pharmacokinetics for mice, and using 70 kg weight and with 1.85 sq.m surface area for humans (U.S. EPA, 1985). A slope factor of 1.2E+0 per (mg/kg)/day was calculated using estimated animal administered doses.

The unit risk should not be used if the air concentration exceeds 2E+2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Sufficient numbers of animals were used for treatment and control groups. Treatment was for approximately 50% of lifetime. Only two dose points provided data suitable for modeling.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health Assessment Document for Vinylidene Chloride. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-83-031F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The values in the 1985 Health Assessment Document for Vinylidene Chloride received extensive peer and public review.

Agency Work Group Review: 12/04/86, 01/07/87

Verification Date: 01/07/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Jean C. Parker / ORD -- (303)293-1789 / FTS 564-1789

Steven P. Bayard / ORD -- (202)260-5722 / FTS 260-5722

, NC. EPA
600/8-83-031F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

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Agency Work Group Review: 12/04/86, 01/07/87

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___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

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---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash promptly
INHALATION: art resp
INGESTION: ipecac, vomit

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if any illness develops, remove person to fresh air promptly, keep warm and quiet, and get medical attention; if breathing stops, start artificial respiration.
INGESTION: not likely a problem; no known antidote; treat symptomically.
EYES OR
SKIN: flush with plenty of water for at least 15 min; get medical attention for eyes; remove contaminated clothing and wash before reuse.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Foam, carbon dioxide, dry chemical. Note: Water may be ineffective. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Vinylidene chloride, inhibited
DOT ID NUMBER: UN1303

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.

Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 210 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: ETHYLENE DICHLORIDE

SYNONYMS: AETHYLENCHLORID (German); 1,2-BICHLOROETHANE; BICHLORURE D'ETHYLENE (French); BORER SOL; BROCIDE; CHLORURE D'ETHYLENE (French); CLORURO DI ETHENE (Italian); DESTRUXOL BORER-SOL; 1,2-DICHLOORETHAAN (Dutch); 1,2-DICHLOR-AETHAN (German); DICHLOREMULSION; 1,2-DICHLORETHANE; DI-CHLOR-MULSION; DICHLORO-1,2-ETHANE (French); alpha,beta-DICHLOROETHANE; sym-DICHLOROETHANE; 1,2-DICHLOROETHANE; DICHLOROETHYLENE; 1,2-DICLOROETANO (Italian); DUTCH LIQUID; DUTCH OIL; EDC; ENT 1,656; ETHANE DICHLORIDE; ETHYLEENDICHLORIDE (Dutch); ETHYLENE CHLORIDE; ETHYLENE DICHLORIDE; ETHYLENE DICHLORIDE (DOT); 1,2-ETHYLENE DICHLORIDE; FREON 150; GLYCOL DICHLORIDE; NCI-C00511; ETHANE, 1,2-DICHLORO-; ENT-1656; DOWFUME; 1,2-ETHYLIDENE DICHLORIDE

CAS: 107-06-2 RTECS: KI0525000

FORMULA: C2H4Cl2 MOL WT: 98.96

WLN: G2G

CHEMICAL CLASS: FT

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: clear liquid with a sweet odor like chloroform [note: decomposes slowly, becomes acidic, and darkens in color.]

BOILING POINT:	356.7 K	83.5 C	182.3 F
MELTING POINT:	237.75 K	-35.4 C	-31.8 F
FLASH POINT:	288.7 K	15.55 C	59.9 F
AUTO IGNITION:	685.92 K	412.7 C	775 F
CRITICAL TEMP:	561 K	287.85 C	550.13 F
CRITICAL PRESS:	5.1 kN/M2	50.2 atm	738 psia
HEAT OF VAP:	138 Btu/lb	76.64 cal/g	3.206x E5 J/kg
HEAT OF COMB:	-3400 Btu/lb	-1890 cal/g	-79x E5 J/kg

VAPOR PRESSURE:	64MM @ 20 C
UEL:	15.6 %
LEL:	6.2 %
IONIZATION POTENTIAL (eV):	10.5
VAPOR DENSITY:	3.4 (air=1)
EVAPORATION RATE:	5.05(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	1.2569
DENSITY:	1.256
WATER SOLUBILITY:	0.8%
INCOMPATIBILITIES:	strong oxidizers, strong caustics, chemically active metals, such as aluminum or magnesium powder, sodium,

potassium

REACTIVITY WITH WATER: N/R - SINKS IN WATER
REACTIVITY WITH COMMON MATERIALS: No data
STABILITY DURING TRANSPORT: No Data
NEUTRALIZING AGENTS: No data
POLYMERIZATION POSSIBILITIES: No data

TOXIC FIRE GASES: TOXIC AND IRRITATING HYDROGEN CHLORIDE AND PHOSGENE GASES
ODOR DETECTED AT (ppm): 100 ppm
ODOR DESCRIPTION: ether-like Source:CHRIS
100 % ODOR DETECTION: No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class: 3 FLAMMABLE LIQUID
DOT guide: 26
Identification number: UN1184
DOT shipping name: Ethylene dichloride
Packing group: II
Label(s) required: FLAMMABLE LIQUID, POISON
Special provisions: T14
Packaging exceptions: 173.None
Non bulk packaging: 173.202
Bulk packaging: 173.243
Quantity limitations-
Passenger air/rail: 1 L
Cargo aircraft only: 60 L
Vessel stowage: B
Other stowage provisions:40

STCC NUMBER: 4909166

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 0.005 mg/L (01/09/89)
Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/09/89)
CLEAN AIR ACT: CAA '90 Listed
EPA WASTE NUMBER: U077,D028,D001
CERCLA REF: Y
RQ DESIGNATION: B 100 pounds (45.4 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: carcinogen
Chronic toxicity: adverse effect to target organ

after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Flammable liquid - Mailable as ORM-D
Mailability: Domestic surface mail only
Max per parcel: 1 GAL

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/90/171422/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DOT Hazardous Materials Table. 49 CFR 172.101
DOT Marine Pollutant. Proposed list. 57 FR 3854, Jan 31, 1992
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA Office of Pesticide Programs. List of active ingredients, 24 April, 1989.
EPA TSCA 8(d) Health and Safety Data Rule - effective date 06/01/87
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
ETHYLENE DICHLORIDE [107-06-2]
Massachusetts Substance List.
National Toxicology Program list of anticipated human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a carcinogen.
New Jersey Right to Know Substance List. Listed as a mutagen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992

Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
TSCA Chemical Hazard Information Profile (CHIP) available - dated 09/01/77
Washington State Discarded Chemical Products List, November 17, 1989
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

---------------------------- TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 10 to 30 ppm may cause dizziness, nausea, and vomiting. levels up to 50 ppm may cause weakness, trembling, headaches, abdominal cramps, liver and kidney damage, and fluid build up in lungs. may cause coma and death at high levels. SKIN: prolonged contact may cause irritation and skin rashes. Eyes: may cause redness, pain, and blurred vision. vapor can damage the cornea. INGESTION: ingestion of 2 ounces has resulted in nausea, vomiting, faintness, drowsiness, difficulty breathing, pale skin, internal bleeding, kidney damage, and death due to respiratory failure. other possible symptoms may include abdominal spasms, severe headache, lethargy, lowered blood pressure, diarrhea, shock, physical collapse, and coma.(NYDH)

LONG TERM TOXICITY: may cause eye, nose and throat irritation, nausea, vomiting, loss of appetite, nerve damage, liver and kidney damage. this substance has been determined to cause cancer in laboratory animals. whether it does so in humans is not known.(NYDH)

TARGET ORGANS: kidneys, liver, eyes, skin, CNS

SYMPTOMS: Inhalation of vapors causes nausea, drunkenness, depression. Contact of liquid with eyes may produce corneal injury. Prolonged contact with skin may cause a burn. Source: CHRIS

CONC IDLH: 50PPM

NIOSH REL: Potential occupational carcinogen 1 ppm Time weighted averages for 8-hour exposure 4 mg/M3 Time weighted averages for 8-hour exposure 2 ppm Ceiling exposures which shall at no time be exceeded 8 mg/M3 Ceiling exposures which shall at no time be exceeded

ACGIH TLV: TLV = 10ppm(40 mg/M3)
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:

PEL = 50 PPM; CEILING = 100 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 3 HOURS = 200

Final Rule Limits:

TWA = 1 ppm (4 mg/M3)

STEL = 2 ppm(8 mg/M3)

MAK INFORMATION: Carcinogenic working material without MAK

In the Commission's view, an animal carcinogen.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.

MAK: An animal carcinogen.

NIOSH: Carcinogen defined by NIOSH with no further categorization.

NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.

ACGIH: Not listed

OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-man TCLo:4000 ppm/1H PCOC** -,500,66
  PERIPHERAL NERVE AND SENSATION
    Flaccid paralysis without anesthesia
  BEHAVIORAL
    Coma
  GASTROINTESTINAL
    Nausea or vomiting

orl-hmn LDLo:286 mg/kg CLCEAL 86,203,47
  GASTROINTESTINAL
    Ulceration or bleeding from stomach
  GASTROINTESTINAL
    Nausea or vomiting
  LIVER
    Fatty liver degeneration

orl-hmn TDLo:428 mg/kg SOMEAU 22(10),132,58
  BEHAVIORAL
    Somnolence(general depressed activity)
  LUNGS, THORAX, OR RESPIRATION
    Cough
  GASTROINTESTINAL
    Nausea or vomiting

orl-man TDLo:892 mg/kg WILEAR 28,983,75
GASTROINTESTINAL
Hypermotility,diarrhea
GASTROINTESTINAL
Nausea or vomiting
LIVER
Jaundice,other or unclassified

LD50 value: orl-rat LD50:670 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:670 mg/kg
ihl-rat LC50:1000 ppm/7H
ipr-rat LD50:807 mg/kg
scu-rat LD50:1 gm/kg
orl-mus LD50:413 mg/kg
ihl-mus LCLo:5 gm/m3/2H
ipr-mus LD50:470 mg/kg
scu-mus LDLo:380 mg/kg
orl-dog LD50:5700 mg/kg
ivn-dog LDLo:175 mg/kg
ihl-mky LC50:3000 ppm/7H
orl-rbt LD50:860 mg/kg
ihl-rbt LCLo:3000 ppm/7H
skn-rbt LD50:2800 mg/kg
scu-rbt LDLo:1200 mg/kg
ihl-pig LCLo:3000 ppm/7H
ihl-gpg LCLo:1500 ppm/7H
ipr-gpg LDLo:600 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 625 mg open MLD
eye-rbt 63 mg SEV

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:300 ppm/7H (6-15D preg) BANRDU 5,149,80
EFFECTS ON FERTILITY
Post-implantation mortality

California Prop 65: Carcinogen (10/01/87)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
1,2-Dichloroethane; CASRN 107-06-2 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- 1,2-Dichloroethane
CASRN -- 107-06-2

Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Based on the induction of several tumor types in rats and mice treated by gavage and lung papillomas in mice after topical application

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

1,2-Dichloroethane in corn oil was administered by gavage to groups of 50 each male and female Osborne-Mendel rats and B6C3F1 mice. Treatment was for 78 weeks followed by an additional observation period of 12-13 weeks for mice or 32 weeks for low-dose rats. TWA dosages were 47 and 95 mg/kg/day for rats, 97 and 195 mg/kg/day for male mice and 149 and 299 mg/kg/day for female mice. All high-dose male rats died after 23 weeks of observation; the last high-dose female died after 15 weeks. Male rats had significantly increased incidence of forestomach squamous-cell carcinomas and circulatory system hemangiosarcomas. Female rats and mice were observed to have significant increases in mammary adenocarcinoma incidence. Mice of both sexes developed alveolar/bronchiolar adenomas, females developed endometrial stromal polyps and sarcomas, and males developed hepatocellular carcinomas (NCI, 1978).

Inhalation exposure of Wistar, Sprague-Dawley rats and Swiss mice did not result in increased tumor incidence (Spencer et al., 1951; Maltoni et al., 1980). An elevation that was not statistically significant in lung adenomas was seen in A/st mice treated i.p. with 1,2-dichloroethane in tricaprylin (Theiss et al., 1977). ICR/Ha Swiss mice treated topically had a significant increase in benign lung papillomas, but not skin carcinomas (van Duuren et al., 1979).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

1,2-Dichloroethane was mutagenic for Salmonella in assays wherein excessive evaporation was prevented; exogenous metabolism by mammalian systems enhanced the response (Nestmann et al., 1980; Barber et al., 1981; Rannug et al., 1978). Both somatic cell mutations and sex-linked recessives were induced in Drosphila (Nylander et al., 1979; Shakarnis, 1969, 1970; King et al., 1979). Metabolites of 1,2-dichloroethane have been shown to form adducts with DNA after in vitro or in vivo exposures.

___II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 9.1E-2 per (mg/kg)/day

Drinking Water Unit Risk -- 2.6E-6 per (ug/L)

Extrapolation Method -- Linearized multistage procedure with time-to-death analysis, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	4E+1 ug/L
E-5 (1 in 100,000)	4E+0 ug/L
E-6 (1 in 1,000,000)	4E-1 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hemangiosarcomas
Test Animals -- rat/Osborne-Mendel, male
Route -- gavage
Reference -- NCI, 1978

Administered Dose (mg/kg/day)	Human Equivalent Dose (mg/kg/day)	Tumor Incidence
0	0	0/40
47	4.46	9/48
95	8.23	7/27

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

Equivalent human dose was calculated using an assumed 70-kg human weight and the reported terminal rat weight of 0.5 kg. Metabolism of 1,2-dichloroethane after oral exposure is dose-dependent. Metabolism was estimated to be <50% saturation at the dose equal to the TWA for rats but near saturation for the high-dose mice in the NCI (1978) bioassay. Because of the high mortality rate in the high-dose rats, a time-to-event analysis was used to quantitate the risk estimate. It was assumed that rats with hemangiosarcomas were killed by the tumors. The 95% upper bound of the risk was calculated using 90 weeks to approximate the lifetime risk.

The unit risk should not be used if the water concentration exceeds 4E+3 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Adequate numbers of animals were treated and observed for the majority of their expected lifespan. The incidence of hemangiosarcoma was significantly elevated in the treated animals and was dose-related. A slope factor of 6.2E-2 (mg/kg)/day, calculated from data on hepatocellular carcinomas in male mice (NCI, 1978), is supportive of the risk estimate.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 2.6E-5 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	4E+0 ug/cu.m
E-5 (1 in 100,000)	4E-1 ug/cu.m

E-6 (1 in 1,000,000)   4E-2 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

The inhalation unit risk was calculated from oral data in Section II.B.2., assuming 100% absorption and metabolism at the low dose.

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

Reitz et al. (1982) found the major urinary metabolites in rats of ingested and inhaled 1,2-dichloroethane to be identical and generated in the same relative amounts.

The unit risk should not be used if the air concentration exceeds 4E+2 ug/cu.m, since above this concentration the unit risk may not be appropriate.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

This inhalation risk estimate was derived from the oral data presented in Section II.B.2. Based on the negative inhalation study of Maltoni et al. (1980), a 95% upper bound on risk was inferred to be 1.0E-6 per (ug/cu.m) approximately 26 times smaller than in the unit risk calculated from the rat gavage data.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health Assessment Document for 1,2-Dichloroethane. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC. EPA 600/8-84-006F.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Health Assessment Document for 1,2-Dichloroethane received both Agency and external review.

Agency Work Group Review: 12/04/86

Verification Date: 12/04/86

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charalingayya B. Hiremath / ORD -- (202)260-5725 / FTS 260-5725

Chao W. Chen / ORD -- (202)260-5898 / FTS 260-5898

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
clean, body-covering clothes & safety glasses with side shields.
respiratory protection: up to 50 ppm, none; 50 ppm to 2%, full face mask & canister; greater than 2%, self-contained breathing apparatus.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes contaminated.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH   (ETHYLENE DICHLORIDE)
Greater at any detectable concentration. : Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome, remove him to fresh air, keep him quiet and warm, and get medical attention immediately; if breathing stops, give artificial respiration.
INGESTION: induce vomiting; call a physician; treat the symptoms.
EYES: flush immediately with copious amounts of flowing water for at

least 15 min.
SKIN: remove clothing and wash skin thoroughly with soap and water; wash contaminated clothing before reuse.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Foam, carbon dioxide, dry chemical. Note: Water may be ineffective. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Ethylene dichloride
DOT ID NUMBER: UN1184

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends

of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 511 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	2-BUTANONE
SYNONYMS:	ACETONE, METHYL-; AETHYLMETHYLKETON (German); BUTANONE; BUTANONE 2 (French); ETHYL METHYL CETONE (French); ETHYLMETHYLKETON (Dutch); ETHYL METHYL KETONE; ETHYL METHYL KETONE (DOT); KETONE, ETHYL METHYL; MEETCO; METHYL ACETONE; METHYL ACETONE (DOT); METHYL ETHYL KETONE; METHYL ETHYL KETONE (DOT); METILETILCHETONE (Italian); METYLOETYLOKETON (Polish); 2-BUTANONE; MEK; BUTAN-2-ONE; KETONE, METHYL ETHYL; 2-OXOBUTANE; METHYL ETHYL KETONE (MEK)
CAS:	78-93-3 RTECS: EL6475000
FORMULA:	C4H8O MOL WT: 72.12
WLN:	2V1
CHEMICAL CLASS:	Ketone

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: clear colorless liquid with a fragrant, mint-like, moderately sharp odor

BOILING POINT:	352.72 K	79.5 C	175.2 F
MELTING POINT:	187.04 K	-86.2 C	-123 F
FLASH POINT:	264.4 K	-8.75 C	16.2 F
AUTO IGNITION:	788.7 K	515.5 C	960 F
CRITICAL TEMP:	535.7 K	262.55 C	504.59 F
CRITICAL PRESS:	4.15 kN/M2	40.9 atm	601 psia
HEAT OF VAP:	191 Btu/lb	106.07 cal/g	4.438x E5 J/kg
HEAT OF COMB:	-13480 Btu/lb	-7494 cal/g	-313x E5 J/kg

VAPOR PRESSURE:	78 mm Hg @ 20 C
UEL:	11.5 %
LEL:	1.8 %
IONIZATION POTENTIAL (eV):	9.54
VAPOR DENSITY:	2.42 (air=1)
EVAPORATION RATE:	7.12
SPECIFIC GRAVITY:	0.806 @ 20 C
DENSITY:	0.805 g/mL @ 20 C
WATER SOLUBILITY:	27%
INCOMPATIBILITIES:	very strong oxidizers, chlorosulfonic acid, oleum, potassium-tert-butoxide, heat or flame, chloroform, hydrogen peroxide, nitric acid

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	NO REACTION Source: SAX
STABILITY DURING TRANSPORT:	No Data

NEUTRALIZING AGENTS:	NOT PERTINENT Source: SAX
POLYMERIZATION POSSIBILITIES:	NOT PERTINENT Source: SAX
TOXIC FIRE GASES:	UNBURNED VAPORS
ODOR DETECTED AT (ppm):	10 ppm
ODOR DESCRIPTION:	Like acetone; pleasant; pungent Source:CHRIS
100 % ODOR DETECTION:	6.0 ppm

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1193
DOT shipping name:	Ethyl methyl ketone [or] methyl ethyl ketone
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T8
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	
STCC NUMBER:	4909243
CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U159,D035,D001
CERCLA REF:	Y
RQ DESIGNATION:	D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Acute toxicity: Irritant Acute toxicity: adverse effect to target organs. Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin. Fire hazard: flammable.
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

2-BUTANONE [78-93-3]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
California Assembly Bill 1803 Well Monitoring Chemicals.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82
EPA TSCA 8(d) Health and Safety Data Rule - effective date 10/04/82
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
First Third Wastes List. 40 CFR 268.10. 54 FR 26594 (June 23, 1989)
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: human exposures to levels of 350 ppm caused irritation of the nose and throat. numbness in fingers, arms and legs accompanied by headache, nausea, vomiting and fainting have occurred after exposure to levels of 300-600 ppm. SKIN: contact with liquid or vapor at levels of 300-600 ppm caused severe irritation. liquid is absorbed readily and may cause numbing of fingers and arms. Eyes: exposure to levels of 200 ppm produced irritation. INGESTION: can cause irritation of the mouth, throat and stomach, the severity of which will be dependent upon amount swallowed. symptoms of poisoning include nausea, vomiting, stomach pain and diarrhea. death can occur from ingestion of as little as 1 ounce. (NYDH)

LONG TERM TOXICITY: has been implicated in certain nervous disorders characterized by weakness, fatigue, heaviness in chest and numbness of hands and feet. these symptoms may develop after 1 year of exposure to vapor concentrations of 50-200 ppm. improvement is gradual and may take years after exposure is discontinued. (NYDH)

TARGET ORGANS: CNS, lungs. peripheral nervous system. eye irritation at 350 ppm.

SYMPTOMS: Liquid causes eye burn. Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness, and loss of consciousness. Source: CHRIS

CONC IDLH: 3000ppm

NIOSH REL: 200 ppm Time weighted averages for 8-hour exposure
590 mg/M3 Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 200ppm(590 mg/M3)
ACGIH STEL: STEL = 300 ppm

OSHA PEL: Transitional Limits:
PEL = 200 ppm(590mg/M3)
Final Rule Limits:
TWA = 200 ppm (590 mg/M3)
STEL = 300 ppm(885 mg/M3)

MAK INFORMATION: 200 ppm
590 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Methyl ethyl ketone (MEK)
CASRN -- 78-93-3
Last Revised -- 12/01/89

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on no human carcinogenicity data and inadequate animal data.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Inadequate. No data were available to assess the carcinogenic potential of methyl ethyl ketone by the oral or inhalation routes. In a skin carcinogenesis study, two groups of 10 male C3H/He mice received dermal applications of 50 mg of a solution containing 25 or 29% methyl ethyl ketone in 70% dodecylbenzene twice a week for 1 year. No skin tumors developed in the group of mice treated with 25% methyl ethyl ketone. After 27 weeks, a single skin tumor developed in 1 of 10 mice receiving 29% methyl ethyl ketone (Horton et al., 1965).

ihl-hmn TCLo:100 ppm/5M JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

LD50 value: orl-rat LD50:2737 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:2737 mg/kg
ihl-rat LC50:23500 mg/m3/8H
ipr-rat LD50:607 mg/kg
orl-mus LD50:4050 mg/kg
ihl-mus LC50:40 gm/m3/2H
ipr-mus LD50:616 mg/kg
skn-rbt LD50:6480 mg/kg
ipr-gpg LDLo:2 gm/kg
ihl-mam LC50:38 gm/m3

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 350 ppm
skn-rbt 500 mg/24H MOD
skn-rbt 402 mg/24H MLD
skn-rbt 13780 ug/24H open MLD
eye-rbt 80 mg

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:3000 ppm/7H (6-15D preg) TXAPA9 28,452,74
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Homeostatis

ihl-rat TCLo:1000 ppm/7H (6-15D preg) TXAPA9 28,452,74
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

California Prop 65: Not listed

----------------------------- EPA's IRIS DATA SUMMARY -------------------------
Methyl ethyl ketone (MEK); CASRN 78-93-3 (04/01/92)

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Methyl ethyl ketone was not mutagenic for Salmonella typhimurium strains TA98, TA100, TA1535, or TA1537 with or without rat hepatic homogenates (Florin et al., 1980; Douglas et al., 1980). Methyl ethyl ketone induced aneuploidy in the diploid D61, M strain of Saccharomyces cerevisiae (Zimmermann et al., 1985). Low levels of methyl ethyl ketone combined with low levels of nocodazole (another inducer of aneuploidy), also produced significantly elevated levels of aneuploidy in the system (Mayer and Goin, 1987).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health and Environmental Effects Profile for Methyl Ethyl Ketone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1988. Updated Health Effects Assessment for Methyl Ethyl Ketone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 Updated Health Effects Assessment for Methyl Ethyl Ketone has received Agency review.

Agency Work Group Review: 05/30/89

Verification Date: 05/30/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm V. Singh / ORD -- (202)260-5958 / FTS 260-5958

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic canister or air pack; plastic gloves; goggles or face shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (2-BUTANONE)
1000 ppm: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
3000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: remove victim to fresh air; if breathing is irregular or has stopped, start resuscitation and administer oxygen.
EYES: wash with plenty of water for at least 15 min. and call physician.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, or carbon dioxide.
Note: Water may be ineffective CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Ethyl methyl ketone [or] methyl ethyl ketone
DOT ID NUMBER: UN1193

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POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it

without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 445 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: ACETONE

SYNONYMS: ACETON (German, Dutch, Polish); ACETONE ; DIMETHYLFORMEHYDE; DIMETHYLKETAL; DIMETHYL KETONE; KETONE, DIMETHYL; KETONE PROPANE; beta-KETOPROPANE; METHYL KETONE; PROPANONE; 2-PROPANONE; PYROACETIC ACID; PYROACETIC ETHER; DIMETHYLFORMALDEHYDE

CAS: 67-64-1 RTECS: AL3150000

FORMULA: C3H6O MOL WT: 58.08

WLN: 1V1

CHEMICAL CLASS: Ketone

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: colorless liquid with a fragrant, mint-like odor

BOILING POINT:	329.27 K	56.1 C	133 F
MELTING POINT:	178.9 K	-94.3 C	-137.7 F
FLASH POINT:	255.32 K	-17.83 C	-.1 F
AUTO IGNITION:	738 K	464.8 C	868.8 F
CRITICAL TEMP:	508 K	234.85 C	454.73 F
CRITICAL PRESS:	4.70 kN/M2	46.3 atm	680 psia
HEAT OF VAP:	220 Btu/lb	122.18 cal/g	5.112x E5 J/kg
HEAT OF COMB:	-12250 Btu/lb	-6810 cal/g	-285x E5 J/kg

VAPOR PRESSURE:	196 mm @ 21 C
UEL:	12.8 %
LEL:	2.6 %
IONIZATION POTENTIAL (eV):	6.87 TO 7.19
VAPOR DENSITY:	2 (air=1)
EVAPORATION RATE:	6.06(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.791 @ 20 C
DENSITY:	0.791
WATER SOLUBILITY:	MISCIBLE
INCOMPATIBILITIES:	ox, acids

REACTIVITY WITH WATER:	No reaction
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data

TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	100 ppm
ODOR DESCRIPTION:	residual; ketonic, pleasant, non-residual Source:CHRIS

100 % ODOR DETECTION: 300 ppm

------------------------------ REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1090
DOT shipping name:	Acetone
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T8
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER: 4908105

CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	U002,D001
CERCLA REF:	Y
RQ DESIGNATION:	D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE:	Not listed

SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Not given
Mailability: Nonmailable
Max per parcel: 0

NFPA CODES:
HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACETONE [67-64-1]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 313 Toxic Chemicals List
Second Third Wastes List. 40 CFR 268.11. 54 FR 26594 (June 23, 1989)
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA ----------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 300 ppm have caused irritation of eyes, nose and throat. levels of 500 to 1,000 ppm for 6 hours have caused, in addition, general weakness and heaviness of the eyelids. exposures of 12,000 ppm for a few minutes may cause weakness in arms and legs and fainting. 20,000 ppm may be fatal on brief exposure. SKIN: liquid acetone may cause drying of the skin, irritation, redness, and an increased chance of infection. Eyes: irritation has been reported at 500 ppm after 3-6 hours. splashes into the eye may result in swelling, irritation, damage to the cornea and blindness. INGESTION: 20 ml (2/3 fluid ounce) may result in excess salivation, nausea, vomiting, stomach pain and possible liver and kidney damage. 200 ml (7 fluid ounces) has resulted in these symptoms and, additionally, swelling of the throat, sores in the mouth and throat, shallow breathing and coma. although 200 ml has been survived with prompt medical attention, death may occur from as little at 100 ml (three and one half fluid ounces).(NYDH)

LONG TERM TOXICITY: levels of 500 to 1,000 ppm can produce eye irritation

after 3 hours. daily exposures at this level have resulted in irritation of throat and lungs, dizziness, and inflammation of stomach and intestines.(NYDH)

TARGET ORGANS: respiratory system, skin, eyes, CNS

SYMPTOMS: INHALATION: vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations. INGESTION: low order of toxicity but very irritating to mucous membranes. SKIN: prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis. Source: CHRIS

CONC IDLH: 2500PPM

NIOSH REL: 250 ppm Time weighted averages for 8-hour exposure
590 mg/M3 Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 750ppm(1780 mg/M3)
ACGIH STEL: STEL = 1000 ppm(2380 mg/M3)

OSHA PEL: Transitional Limits:
PEL = 1000 ppm(2400mg/M3)
Final Rule Limits:
TWA = 750 ppm (1800 mg/M3)
STEL = 1000 ppm(2400 mg/M3)
STEL DOES NOT APPLY TO THE CELLULOSE ACETATE FIBER INDUSTRY.

MAK INFORMATION: 500 ppm
1200 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
orl-man TDLo:2857 mg/kg 34ZIAG -,64,69
BEHAVIORAL
Coma
KIDNEY,URETER,BLADDER
Other changes

orl-man TDLo:2857 mg/kg DIAEAZ 15,810,66
BEHAVIORAL

Coma
BIOCHEMICAL
Metabolism
Other

ihl-man TCLo:440 ug/m3/6M GISAAA 42(8),42,77
BRAIN AND COVERINGS
Recordings from specific areas of CNS

ihl-man TCLo:10 mg/m3/6H GISAAA 42(8),42,77
BIOCHEMICAL
Metabolism
Other carbohydrates

ihl-hmn TCLo:500 ppm JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

ihl-man TCLo:12000 ppm/4H AOHYA3 16,73,73
GASTROINTESTINAL
Nausea or vomiting
BEHAVIORAL
Muscle weakness

LD50 value: orl-rat LD50:5800 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5800 mg/kg
ihl-rat LC50:50100 mg/m3/8H
ipr-rat LDLo:500 mg/kg
ivn-rat LD50:5500 mg/kg
orl-mus LD50:3 gm/kg
ihl-mus LCLo:110 gm/m3/1H
ipr-mus LD50:1297 mg/kg
ivn-mus LDLo:4 gm/kg
orl-dog LDLo:8 gm/kg
ipr-dog LDLo:8 gm/kg
scu-dog LDLo:5 gm/kg
orl-rbt LD50:5340 mg/kg
skn-rbt LD50:20 gm/kg
ivn-rbt LDLo:1576 mg/kg
skn-gpg LD50:>9400 mg/kg
scu-gpg LDLo:5 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 500 ppm
skn-rbt 395 mg open MLD
eye-rbt 3950 ug SEV

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:273 gm/kg (13W male) NTIS** PB91-185975
PATERNAL EFFECTS
Spermatogenisis

California Prop 65: Not listed

---------------------------- EPA's IRIS DATA SUMMARY -------------------------
Acetone; CASRN 67-64-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Acetone
CASRN -- 67-64-1
Last Revised -- 12/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on lack of data concerning carcinogenicity in humans or animals.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

None.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Acetone did not show mutagenic activity when tested in Salmonella typhimurium strains TA98 and TA100 or in Schizosaccharomyces pombe strain P1 either in the presence or absence of liver homogenates (McCann et al., 1975; Abbondandolo et al., 1980; Maron et al., 1981; Hallstrom et al., 1981) or in cell transformation systems (Freeman et al., 1973; Rhim et al., 1974; Quarles et al., 1979a,b). Furthermore, acetone gave negative results in assays for chromosomal aberrations and sister chromatid exchange (Norppa et al., 1981; Norppa, 1981; Tates and Kriek, 1981), DNA binding (Kubinski et al., 1981), point mutation in mouse lymphoma cells (Amacher et al., 1980), and transfection of E. coli CR63 cells (Vasavada and Padayatty, 1981). In one study, however, acetone was reported to produce chromosomal aberrations but not sister chromatid exchanges (Kawachi et al., 1980).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1988. Updated Health Effects Assessment for Acetone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and

Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 updated Health Effects Document for Acetone has received Agency review and is approved for publication.

Agency Work Group Review: 12/06/89

Verification Date: 12/06/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charles Ris / ORD -- (202)260-5895 / FTS 260-5898

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister or air-supplied mask; synthetic rubber gloves; chemical safety goggles or face splash shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (ACETONE)
1000 ppm: Any chemical cartridge respirator with organic vapor cartridge(s). / Any powered air-purifying respirator with organic vapor cartridge(s). / Any supplied-air respirator. / Any self-contained breathing apparatus.
6250 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require

eye protection.
12500 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece.
20000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: flush with water immediately for at least 15 min. consult a physician.
SKIN: wash well with water.
INHALATION: if victim overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: seek immediate medical attention

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: if victim has swallowed large amounts and is conscious and not having convulsions, induce vomiting and get medical help promptly; no specific antidote known.
SKIN: wash well with water.
EYES: flush with water immediately for at least 15 min. Consult a physician.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, carbon dioxide. Note: Water in straight hose stream will scatter and spread fire and should not be used. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Acetone

DOT ID NUMBER: UN1090

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.

*HEALTH HAZARDS

May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

--------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 1655 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	DICHLOROMETHANE
SYNONYMS:	AEROTHENE MM; CHLORURE DE METHYLENE (French); DCM; DICHLOROMETHANE; DICHLOROMETHANE (DOT); FREON 30; METHANE DICHLORIDE; METHYLENE BICHLORIDE; METHYLENE CHLORIDE; METHYLENE CHLORIDE (DOT); METHYLENE DICHLORIDE; METYLENU CHLOREK (Polish); NARKOTIL; NCI-C50102; SOLAESTHIN; SOLMETHINE; METHANE, DICHLORO-
CAS:	75-09-2 RTECS: PA8050000
FORMULA:	CH2Cl2 MOL WT: 84.93
WLN:	G1G
CHEMICAL CLASS:	ST

See other identifiers listed below under Regulations.

--------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless liquid with a chloroform-like odor [note: a gas above 104 f]

BOILING POINT:	313.15 K	40 C	104 F
MELTING POINT:	176.49 K	-96.7 C	-142 F
FLASH POINT:		Not available	
AUTO IGNITION:	913 K	639.8 C	1183.8 F

VAPOR PRESSURE:	350mm @ 20 C
UEL:	19 %
LEL:	12 %
IONIZATION POTENTIAL (eV):	11.35
VAPOR DENSITY:	2.9 (air=1)
EVAPORATION RATE:	14.50(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	1.33
DENSITY:	1.36174g/mL @ 0 C
WATER SOLUBILITY:	1.3%
INCOMPATIBILITIES:	strong oxidizers, strong caustics, chemically active metals, such as aluminum or magnesium powders; sodium, potassium. reacts violently with lithium, sodium potassium alloy, potassium-tert-butoxide, (potassium hydroxide+n-methyl-n-nitrosourea) ■sax

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data

TOXIC FIRE GASES:	PHOSGENE/CORROSIVE. HIGHLY TOXIC ARID IRRITATING FUMES ■THIC. WHEN HEATED TO

	DECOMPOSE, EMITS HIGHLY TOXIC FUMES OF PHOSGENE ■SAX.
ODOR DETECTED AT (ppm):	214 PPM
ODOR DESCRIPTION:	SWEETISH (LIKE CHLOROFORM OR ETHER) Source:NYDH
100 % ODOR DETECTION:	No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class:	6.1 POISON
DOT guide:	74
Identification number:	UN1593
DOT shipping name:	Dichloromethane
Packing group:	III
Label(s) required:	KEEP AWAY FROM FOOD
Special provisions:	N36,T13
Packaging exceptions:	173.153
Non bulk packaging:	173.203
Bulk packaging:	173.241
Quantity limitations-	
Passenger air/rail:	60 L
Cargo aircraft only:	220 L
Vessel stowage:	A
Other stowage provisions:	

STCC NUMBER: 4941132

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
  Maximum Contaminant Levels (MCL): 0.005 mg/L (01/17/94)
  Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/17/94)

CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U080
CERCLA REF:	Y
RQ DESIGNATION:	C 1000 pounds (454 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	
	Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat).
	Acute toxicity: Irritant
	Acute toxicity: adverse effect to target organs.
	Chronic toxicity: carcinogen
	Chronic toxicity: adverse effect to target organ after long period of exposure.
	Chronic toxicity: mutagen.
	Chronic toxicity: reproductive toxin.
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: ORM-A
Mailability: Domestic service and air transportation shipper's declaration required
Max per parcel: 10 GAL; 1 PT

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (1) This material must be preheated before ignition can occur.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/89/194468/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Department of Health Services Drinking Water Action List.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DICHLOROMETHANE [75-09-2]
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA Office of Pesticide Programs. List of active ingredients, 24 April, 1989.
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82
EPA TSCA 8(d) Health and Safety Data Rule - effective date 10/04/82
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
National Toxicology Program list of anticipated human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Suspected carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 300-700 ppm for 3-5 hours has caused slight loss of muscle control and coordination. effects of higher concentrations include stupor, dizziness, chest pain, arm and leg pains, loss of feeling, loss of appetite, hot flashes and death. SKIN: may be irritating if confined on the skin by gloves or clothing. may be absorbed slowly through the skin to cause symptoms listed under inhalation. Eyes: may cause pain, irritation and burns. INGESTION: accidental ingestion of paint removers containing methylene chloride as the main ingredient have reportedly caused headache, nausea, vomiting, visual disturbance, presence of blood in the urine, and unconsciousness.(NYDH)

LONG TERM TOXICITY: same symptoms as above. prolonged exposure can cause changes in blood, hallucinations and decreased response to visual and auditory stimulation. some long term exposures have also resulted in damage to the liver. most of the effects will disappear after exposure stops. methylene chloride caused genetic effects in certain bacteria and caused birth defects in chickens. in laboratory studies, methylene chloride has also been shown to cause tumors in mice and rats. whether methylene chloride causes defects or tumors in humans is not known.(NYDH)

TARGET ORGANS: skin, cvs, eyes, CNS

SYMPTOMS: INHALATION: anesthetic effects, nausea and drunkenness. CONTACT WITH SKIN AND EYES: skin irritation, irritation of eyes and nose. Source: CHRIS

CONC IDLH: 2300PPM

NIOSH REL: Potential occupational carcinogen --LOWEST FEASIBLE

ACGIH TLV: TLV = 50ppm Suspected human carcinogen (A2)
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 500 PPM; CEILING = 1000 PPM; MAXIMUM PEAK FOR 5 MINUTES IN ANY 2 HOURS = 2000
Final Rule Limits:
TWA = 500 ppm
CEILING = 1000 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 2 HOURS = 2000 ppm

MAK INFORMATION: 100 ppm

360 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.
ACGIH: Carcinogen defined by ACGIH TLV Committee as a suspected carcinogen, based on either limited epidemiological evidence or demonstration of carcinogenicity in experimental animals.
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-hmn LDLo:357 mg/kg 34ZIAG -,390,69
  PERIPHERAL NERVE AND SENSATION
    Paresthesia
  BEHAVIORAL
    Somnolence(general depressed activity)
  BEHAVIORAL
    Convulsions or effect on seizure threshold

ihl-hmn TCLo:500 ppm/1Y-I ABHYAE 43,1123,68
  BEHAVIORAL
    Altered sleep time(including change in righting reflex)
  BEHAVIORAL
    Somnolence(general depressed activity)
  CARDIAC
    Change in rate

LD50 value: orl-rat LD50:1600 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:1600 mg/kg
ihl-rat LC50:88 gm/m3/30M
ipr-rat LD50:916 mg/kg
ihl-mus LC50:14400 ppm/7H

ipr-mus LD50:437 mg/kg
scu-mus LD50:6460 mg/kg
unr-mus LD50:4770 mg/kg
orl-dog LDLo:3 gm/kg
ihl-dog LCLo:14108 ppm/7H
ipr-dog LDLo:950 mg/kg
ivn-dog LDLo:200 mg/kg
ihl-cat LCLo:43400 mg/m3/4.5H
orl-rbt LDLo:1900 mg/kg
ihl-rbt LCLo:10000 ppm/7H
scu-rbt LDLo:2700 mg/kg
ihl-gpg LCLo:5000 ppm/2H

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 810 mg/24H SEV
eye-rbt 162 mg MOD
eye-rbt 10 mg MLD

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:4500 ppm/24H (1-17D preg) TXAPA9 52,29,80
EFFECTS ON NEWBORN
Behavioral

ihl-rat TCLo:1250 ppm/7H (6-15D preg) TXAPA9 32,84,75
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

California Prop 65: Carcinogen (04/01/88)
No significant risk level-inhalation 200. ugD (01/01/94)
No significant risk level 50. ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Dichloromethane; CASRN 75-09-2 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Dichloromethane
CASRN -- 75-09-2
Primary Synonym -- Methylene Chloride
Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a

low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification --B2; probable human carcinogen

Basis -- Based on inadequate human data and sufficient evidence of carcinogenicity in animals; increased incidence of hepatocellular neoplasms and alveolar/bronchiolar neoplasms in male and female mice, and increased incidence of benign mammary tumors in both sexes of rats, salivary gland sarcomas in male rats and leukemia in female rats. This classification is supported by some positive genotoxicity data, although results in mammalian systems are generally negative.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. Neither of two studies of chemical factory workers exposed to dichloromethane showed an excess of cancers (Ott et al., 1983; Friedlander et al., 1978; Hearne and Friedlander, 1981). The Ott et al. (1983) study was designed to examine cardiovascular effects, and consequently the study period was too short to allow for latency of site-specific cancers. In the Friedlander et al. (1978) study, exposures were low, but the data provided some suggestion of an increased incidence of pancreatic tumors. This study was recently updated to include a larger cohort, followed through 1984, and an investigation of possible confounding factors (Hearne et al., 1986, 1987). A nonsignificant excess in pancreatic cancer deaths was observed, which was interpreted by EPA (1987a) as neither clear evidence of carcinogenicity in humans, nor evidence of noncarcinogenicity. An update of the Ott et al. (1983) study, based on longer follow-up, indicated possible elevation of liver and biliary tract cancers (TSCA section 8(e) submission no. 8eHQ-0198-0772 FLWP et seq., 1989).

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Dichloromethane administered in the drinking water induced a significant increase in combined hepatocellular carcinoma and neoplastic nodules in female F344 rats and a nonsignificant increase in combined hepatocellular carcinoma and neoplastic nodules in male B6C3F1 mice (NCA, 1982, 1983). Two inhalation studies with dichloromethane have shown an increased incidence of benign mammary tumors in both sexes of Sprague-Dawley (Burek et al., 1984) and F344 (NTP, 1986) rats. Male Sprague-Dawley rats had increased salivary gland sarcoma (Burek et al., 1984) and female F344 rats had increased leukemia incidence (NTP, 1986). Both sexes of B6C3F1 mice developed liver and lung tumors after dichloromethane treatment (NTP, 1986).

In a 2-year study by the National Coffee Association (1982, 1983), groups of 85 F344 rats/sex/dose received 5, 50, 125, or 250 (mg/kg)/day of dichloromethane in the drinking water. Control groups consisted of 135 rats/sex. In female rats the incidence of combined hepatocellular carcinoma and neoplastic nodules was statistically significantly increased in the 50 and 250 mg/kg dose groups when compared with matched controls (0/134, 1/85, 4/83, 1/85, and 6/85 in the five dose groups 0, 5, 50, 125, and 250 (mg/kg)/day, respectively). The incidence of hepatocellular carcinoma alone was not significantly increased (0/134, 0/85, 2/83, 0/85, 2/85). The combined incidence of hepatocellular carinoma and neoplastic nodules in controls and the 4 dose groups (472 rats: 4 with carcinoma and 8 with neoplastic nodules) was similar to that for historical controls (419 rats; 5 with carcinoma, 19 with neoplastic nodules). Male rats showed no increase in liver tumors.

In the same National Coffee Association study (1982, 1983), B6C3F1 mice received 0, 60, 125, 185, or 250 (mg/kg)/day of dichloromethane in drinking water. Treatment groups consisted of 50 female mice and 200, 100, 100, and 125 male mice (low to high dose). One hundred females and 125 males served as controls. Male mice had an increased incidence of combined neoplastic nodules and hepatocellular carcinoma (24/125, 51/200, 30/100, 31/99, 35/125). The increase was not dose-related, but the pairwise comparisons for the two mid-dose groups were reported to be statistically significant (U.S. EPA, 1985a). The hepatocellular carcinoma incidence alone for male mice (which was about 55 to 65% of the total) was not significantly elevated. Female mice did not have increased liver tumor incidence. The EPA (1985b) regarded this study as suggestive but not conclusive evidence for carcinogenicity of dichloromethane.

A gavage bioassay of dichloromethane conducted by NTP (1982) has not been published because of high mortality, much of which was attributed to gavage accidents.

Inhalation exposure of 107 to 109 Syrian hamsters/sex/dose to 0, 500, 1500, or 3500 ppm of dichloromethane for 6 hours/day, 5 days/week for 2 years did not induce neoplasia (Burek et al., 1984). Sprague-Dawley rats (129/sex/dose) were exposed under the same conditions. Female rats administered the highest dose experienced significantly reduced survival from 18-24 months. Female rats showed a dose-related increase in the average number of benign mammary tumors per rat (1.7, 2.3, 2.6, 3.0), although the numbers of rats with tumors were not significantly increased. A similar response was observed in male rats, but to a lesser degree. In the male rats there was a statistically significant positive trend in the incidence of sarcomas of the salivary gland (1/93, 0/94, 5/91, 11/88); the incidence was significantly elevated at the high dose. There is a question as to whether these doses reached the MTD, particularly in the hamsters and the male rats. In another study (Dow Chemical Co., 1982), 90 Sprague-Dawley rats/sex were exposed by inhalation to 0, 50, 200, or 500 ppm dichloromethane for 20 months (male) or 24 months (female). No salivary tumors were observed, but there was an exposure-related increase in the total number of benign mammary tumors in female rats, although the increase was not statistically significant in any individual exposure group.

Groups of 50 each male and female F344/N rats and B6C3F1 mice were exposed to dichloromethane by inhalation, 6 hours/day, 5 days/week for 2 years (NTP, 1986). Exposure concentrations were 0, 1000, 2000, or 4000 ppm for rats and 0, 2000, or 4000 ppm for mice. Survival of male rats was low; however, this apparently was not treatment-related. Survival was decreased in a treatment-related fashion for male and female mice and female rats. Mammary adenomas and fibroadenomas were significantly increased in male and female rats after survival adjustment, as were mononuclear cell leukemias in female rats. Among treated mice of both sexes there were significantly increased incidences of hepatocellular adenomas and carcinomas, and of alveolarbronchiolar adenomas and carcinomas, by life table tests. Adenomas and carcinomas were significantly increased alone as well as in combination. In addition, there were significant dose-related increases in the number of lung tumors per animal multiplicity in both sexes of mice.

Two inhalation assays using dogs, rabbits, guinea pigs, and rats showed no tumors, but were not conducted for the lifetime of the animals (Heppel et al., 1944; MacEwen et al., 1972). Theiss et al., (1977) injected Strain A male mice intraperitoneally with 0, 160, 400, or 800 mg/kg of dichloromethane 16 to 17 times, over 5 to 6 weeks. Survival of the animals was poor. The animals remaining 24 weeks after the first treatment were killed and examined for lung tumors; pulmonary adenomas were found.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Dichloromethane was mutagenic for Salmonella typhimurium with or without the addition of hepatic enzymes (Green, 1983) and produced mitotic recombination in yeast (Callen et al., 1980). Results in cultured mammalian cells have generally been negative, but dichloromethane has been shown to transform rat embryo cells and to enhance viral transformation of Syrian hamster embryo cells (Price et al., 1978; Hatch et al., 1983). Although chlorinated solvents have often been suspected of acting through a nongenotoxic mechanism of cell proliferation, Lefevre and Ashby (1989) found methylene chloride to be unable to induce hepatocellular division in mice.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 7.5E-3 per (mg/kg)/day

Drinking Water Unit Risk -- 2.1E-7 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	5E+2 ug/L
E-5 (1 in 100,000)	5E+1 ug/L
E-6 (1 in 1,000,000)	5E+0 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hepatocellular adenomas or carcinomas (NTP) and hepatocellular cancer and neoplastic nodules (NCA)
Test Animals -- mouse/B6C3F1 (female, NTP; male, NCA)
Route -- inhalation (NTP); drinking water (NCA)
Reference -- NTP, 1986; National Coffee Association (NCA), 1983

Dose				
Administered		Human Equivalent	Tumor	
(ppm)	mg/kg/day	(mg/kg)/day	Incidence	Reference
0	0	0	3/50	NTP, 1986
2000	1582	122	16/48	
4000	3162	244	40/48	
	0	0	24/125	NCA, 1983
	60	4.5	51/200	
	125	9.4	30/100	
	185	14.0	31/99	
	250	18.9	35/125	

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

The slope factor is an arithmetic mean of slope factors derived from NTP(1986) and the National Coffee Association (1983) data, 2.6E-3 per (mg/kg)/day and 1.2E-2 per (mg/kg)/day, respectively. The use of liver tumor data from the NTP inhalation bioassay was considered valid since dichloromethane is rapidly absorbed following either inhalation or ingestion.

Dose conversions used the mean body weight for female mice at the midpoint of the bioassay, and an estimated inhalation rate of 0.0407 cu.m/day. To obtain estimates of unit risk for humans, an inhalation rate of 20 cu.m/day was assumed. Dichloromethane was considered to be well-absorbed as a vapor at low doses. No pharmacokinetic or metabolism data have been used to modify the oral unit risk estimate, because such analyses have not yet been carried out.

The unit risk should not be used if the water concentration exceeds 5E+4 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Adequate numbers of animals were used in both assays. Risk estimates were based on the more sensitive sex in each study. The two risk estimates were within a factor of 5.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 4.7E-7 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E+2 ug/cu.m
E-5 (1 in 100,000)	2E+1 ug/cu.m
E-6 (1 in 1,000,000)	2E+0 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- combined adenomas and carcinomas
Test Animals -- mouse/B6C3F1, female
Route -- inhalation
Reference -- NTP, 1986

	Dose			
Tumor Type	Administered (ppm)	Transformed Animal (mg/kg)/day	Human Equivalent (mg/kg)/day	Tumor Incidence
Liver	0	0	0	3/45
	2000	1582	356	16/46
	4000	3162	712	40/46

Lung	0	0	0	3/45
	2000	1582	356	30/46
	4000	3162	712	41/46

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk of 4.7E-7 per (ug/cu.m), which incorporates information on pharmacokinetics and metabolism of dichloromethane, is approximately nine-fold lower than the previous applied dose estimate (U.S. EPA, 1987a,b). Internal dose estimates were based on the metabolism of dichloromethane by the glutathione-s-transferase pathway, as estimated by the model developed by Andersen et al. (1987). The internal dose was corrected for interspecies differences in sensitivity by using the surface area correction factor.

Calculation of a slope factor from the unit risk is inappropriate when pharmacokinetic models are used. (When dose-response relationships are figured on the basis of internal or metabolized dose, a slope factor in terms of per (mg/kg)/day represents a back calculation using different absorption assumptions than the pharmacokinetic models. This introduces possible contradictions.)

The unit risk should not be used if the air concentration exceeds 2E+4 ug/cu.m, since above this concentration the unit risk may differ from that stated. Since the unit risk is based on a pharmacokinetic model, the risk may change with alterations in exposure patterns. Thus, the unit risk presented here may not be applicable to acute, high exposures.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Adequate numbers of animals were observed and tumor incidences were significantly increased in a dose-dependent fashion. Analysis excluding animals that died before observation of the first tumors produced similar risk estimates, as did time-to-tumor analysis. The use of animal and human metabolism and pharmacokinetic data reduces some of the uncertainty typically associated with dose-risk extrapolation. A great deal of uncertainty still exists, however, in the estimates of internal dose generated by the model of Andersen et al. (1987). Important uncertainties remain regarding the pharmacokinetics, pharmacodynamics, and mechanisms of carcinogenicity for dichloromethane.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985a. Health Assessment Document for Dichloromethane (Methylene Chloride). Final Report. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/8-82/004F.

U.S. EPA. 1985b. Addendum to the Health Assessment Document for Dichloromethane (methylene chloride). Updated carcinogenicity assessment. Prepared by the Carcinogen Assessment Group, OHEA, Washington, DC. EPA/600/8-82/004FF.

U.S. EPA. 1987a. Update to the Health Assessment Document and Addendum for Dichloromethane (Methylene Chloride): Pharmacokinetics, Mechanism of Action and Epidemiology. Review Draft. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8-87/030A.

U.S. EPA. 1987b. Technical Analysis of New Methods and Data Regarding Dichloromethane Hazard Assessments. Review Draft. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8- 87/029A.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Health Assessment Document, the Update to the Health Assessment Document and Addendum, and the Technical Analysis of New Methods and Data for dichloromethane have received Agency and external review, including a review by the Science Advisory Board (SAB). Although the last two documents are not yet finalized and the SAB comments are not yet incorporated, these do not alter this document's analyses or conclusions.

Agency Work Group Review: 11/12/86, 12/04/86, 04/06/89

Verification Date: 04/06/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Lorenz Rhomberg / ORD -- (202)260-5723 / FTS 260-5723

Dharm V. Singh / ORD -- (202)260-5898 / FTS 260-5898

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister mask, safety glasses, protective clothing.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:

Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes wet.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (DICHLOROMETHANE)
750 ppm: Any supplied-air respirator. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection.
1875 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require eye protection.
3750 ppm: Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
5000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: remove from exposure. Give oxygen if needed.
INGESTION: no specific antidote. CONTACT WITH
SKIN AND
EYES: remove contaminated clothing; wash skin or eyes if affected.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: USE WATER SPRAY TO KEEP FIRE-EXPOSED CONTAINERS COOL AND TO FLUSH SPILLAGE TO AVOID FURTHER EXPOSURES. Note: CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Dichloromethane
DOT ID NUMBER: UN1593

ERG93 GUIDE 74

POTENTIAL HAZARDS

*HEALTH HAZARDS
Vapors may cause dizziness or suffocation.
Exposure in an enclosed area may be very harmful.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Most vapors heavier than air.
*Air/vapor mixtures may explode when ignited.
Container may explode in heat of fire.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical or CO2.
Large Fires: Water spray, fog or regular foam.
Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

Attachment B

Drilling Safety Guide

Drilling Safety Guide

EnSafe is concerned about employee safety while working on or around drill rigs as well as when traveling to and from a drilling site, moving the drill rig and tools from location to location on a site and during maintenance of the drill rig. Every drill crew will have a designated safety supervisor. The safety supervisor will have the responsibility for ensuring that all drilling operations are conducted in a safe manner. All personnel working on, with, or around a drill rig will be under the jurisdiction of the rig safety supervisor.

Drill Rig Safety Supervisor

The safety supervisor for the drill crew will be the drill rig operator. However, the EnSafe safety officer still maintains the overall safety responsibility for the site. The drill crew safety supervisor is a direct representative of the site health and safety supervisor and will report any safety problems directly to the site health and safety officer. The drill rig safety supervisor will:

- Be the leader in using proper personal protective equipment. He/she will set an example for other personnel to follow.

- Enforce the requirements of the health and safety plan and take appropriate actions when other personal are not following the requirements of the health and safety plan.

- Ensure that all drill rig and associated drill rig equipment is properly maintained.

- Ensure that all drill rig operating personnel are thoroughly familiar with the drill operations.

- Inspect the drill rig and associated drill rig equipment for damage before starting drilling operations. Check for structural damage, loose bolts or nuts, correct tension in chains and cables, loose or missing guards or protective covers, fluid leaks, damaged hoses and or damaged pressure gauges and pressure relief valves.

- Test all emergency and warning devices such as emergency shut-down switches at least daily (prior to starting drilling operations). Drilling will not be permitted until all emergency and warning devices are functioning.

- Conduct a safety briefing daily before starting drilling operations. Any new employee will receive a copy of the drilling operations safety manual, and the drill rig manufacturer's operating and maintenance manual.

- Ensure that each employee reads and understands the drill rig manufacturer's operating and maintenance manual.

- Observe the mental, emotional, and physical capabilities of each worker.

- Ensure that each drill rig has a first aid kit and fire extinguisher.

- Maintain a list of emergency contact telephone numbers. This list will be posted in a prominent location and each drill rig employee will be informed of the lists location.

Drill Rig Personnel Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling, drill rig personal protective equipment will include the following:

- Hard hat
- Safety shoes with steel toe and steel shank (or equivalent)
- Gloves

- Safety glasses with side shields
- Close fitting but comfortable clothes
- Hearing protection

It is important that clothing does not have loose ends, straps, draw strings or belts, or other unfastened parts that might become caught in or on a rotating or translating part of the drill rig.

Rings, necklaces, or other jewelry will not be worn during drilling operations.

Additional protective equipment may be required by the site specific health and safety plan.

Drill Rig Housekeeping

The following housekeeping measures must be taken for all drilling operations.

- Suitable storage locations will be provided for all tools, materials and supplies. The storage should be conveniently located and will provide for safe handling of all supplies.

- Drill tools, supplies, and materials will not be transported on the drill rig unless the drill rig is designed and equipped to carry drill tools, supplies, and materials.

- Pipe, drill rods, casing, augers, and similar drilling tools when stored will be stacked in a manner that will prevent spreading, rolling, or sliding.

- Penetration or other driving hammers will be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.

- Never store gasoline in a non-approved container. Red, non-sparking, vented containers marked with the word gasoline will be used. The fill spout will have a flame arrester.

- Prior to drilling, adequate site clearing and leveling will be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling will not be started when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

Maintenance Safety

Well maintained drilling equipment makes drilling operations safer. When performing equipment/tool maintenance, the follow safety precautions will be followed:

- Safety glasses will be worn when maintenance is performed on drill rigs or drilling tools.

- Shut down the drill rig engine to make repairs or adjustments to the rig or to lubricate fittings (except to make repairs or adjustments that can only be made while the engine is running).

- Always block the wheels or lower the leveling jacks or both. Set the hand brake before working under a drill rig.

- Release all pressure on hydraulic systems, the drilling fluid system, and the air operating system of the drill rig prior to performing maintenance.

- Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.

- Allow time for the engine and exhaust to cool before performing maintenance on these systems.

- Never weld or cut on or near the fuel tank.

- Do not use gasoline or other volatile or flammable liquids as a cleaning agent.

- Follow the manufacturer's recommendations for quantity and type of lubricants, hydraulic fluids and coolants.

- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed during maintenance.

- Perform a safety inspection prior to starting drilling equipment after maintenance is performed.

Safe Use of Hand Tools

There are a large number of hand tools that can be used on or around a drill rig. The most important rule of hand tools is to use a tool for its intended purpose. The following are a few general and specific safety rules to follow when using hand tools.

- When using a hammer, wear safety glasses and require all others around you to wear safety glasses.

- When using a chisel, wear safety glasses and require all others around you to wear safety glasses.

- Keep all tools cleaned and stored in an orderly manner.

- Use wrenches on nuts, not pliers.

- Use screwdrivers with blades that fit the screw slot.

- When using a wrench on a tight nut, use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing. Check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches will be wire brushed frequently to prevent accumulation of dirt and grease which cause wrenches to slip.

- Never use pipe wrenches in place of a rod holding device.

- Replace hock and heel jaws when visibly worn.

- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform if the wrench were to slip or the joint suddenly to let go.

Safety During Drilling Operations

- Do not drive a drill rig from hole to hole with the mast (derrick) in the raised position.

- Before raising the mast, look up to check for overhead obstructions.

- Before raising the mast, all drill rig personnel (except the person raising the mast) and visitors will be cleared from the area immediately to the rear and sides of the mast. All drill rig personnel and visitors will be informed that the mast is being raised prior to raising the mast.

- All drill rig personnel and visitors will be instructed to stand clear of the drill rig immediately prior to and during starting of the engine.

- All gear boxed will be in the neutral position, all hoist levers will be disengaged, all hydraulic levers will be in the non-actuating positions, and the cathead rope will not be on the cathead before starting the drill rig engine.

- The drill rig must be leveled and stabilized with leveling jacks and/or solid cribbing before the mast is raised. The drill rig will be leveled if settling occurs after initial set up.

- The mast will be lowered only when the leveling jacks are down. The leveling jacks must be in the down position until the mast is completely lowered.

- Secure and/or lock the mast according to the drill rig manufacturer's recommendations before starting drilling operations.

- The initial 4 feet will be drilled manually (via post hole digger or hand auger) to ensure clearance from unmarked utilities, unless approval is obtained from the project manager and project health and safety officer. If manual drilling is not possible, metal-detecting equipment will be used to locate utilities at drilling intervals of one foot until a depth of 4 feet is obtained.

- The drill rig must only be operated from the control position. If the operator must leave the control position, the rotary drive and the feed control must be placed in the neutral position. The drill engine will be shut down when the operator leaves the vicinity of the drill rig.

- Throwing or dropping of tools is not permitted. All tools will be carefully passed by hand between personnel or a hoist line will be used.

- When drilling within an enclosed area, ensure that fumes are exhausted out of the area. Exhaust fumes can be toxic and may not be detected by smell.

- Clean mud and grease from boots before mounting the drill platform. Use hand holds and railings. Watch for slippery ground when dismounting from the drill platform.

- Do not touch any metal parts of the drill rig with exposed flesh during freezing weather. Freezing of moist skin to metal can occur almost instantaneously.

- All unattended id,<,d, must be covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.

- Do not attempt to use one or both hands to carry tools when climbing ladders.

Working on Derrick Platforms

- When working on a derrick platform, us a safety belt and a lifeline. The safety belt will be at least 4 inches wide and will fit snugly but comfortably. The lifeline, will be less than 6 feet long and attached to the derrick.

- The safety belt and lifeline will be strong enough to withstand the dynamic force of a 250 pound weight falling 6 feet.

- A safety climbing device will be used when climbing to a derrick platform that is higher than 20 feet.

- The lifeline will be fastened to the derrick just above the derrick platform to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- Tools will be securely attached to the platform with safety lines. Do not attach a tool to a line attached to the wrist or other body part.

- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.

- Derrick platforms over 4 feet above the ground will have toe boards and safety railings.

Working on the Ground

- Workers on the ground must avoid going under elevated platforms.

- Terminate drilling operations and if possible lower the mast during an electrical storm.

- Overhead and buried utilities must be located and marked on all boring location plans and boring assignment sheets.

- When there are overhead electrical power lines at or near a drilling site or project, consider all wire to be charged and dangerous.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entry. Call the utility to have them lift the power lines or to deenergize the power.

- Operations adjacent to overhead lines are prohibited unless on of the following conditions is satisfied:

  — Power has been shut off and positive means taken to prevent the lines from being energized.

  — Equipment, or any part, does not have the capability of coming within the following minimum clearance from energized overhead lines, or the equipment has been positioned and blocked to assure no part, including cables can come within the following minimum clearances:

Power Lines Nominal System kv	Minimum Required Clearance
0 - 50	10 feet
51 - 100	12 feet
101 - 200	15 feet
201 - 300	20 feet
301 - 500	25 feet
501 - 750	35 feet
751 - 1000	45 feet

- While in transit with boom lowered and no load, the equipment clearance will be a minimum of 4 feet for voltages less than 50kv, 10 feet for voltages 51kv to 345kv, and 16 feet for voltages over 345kv.

- Before working near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized. The following precautions will be taken to dissipate induced voltages:

    — The equipment will be provided with an electrical ground to the upper rotating structure supporting the boom.

    — Ground jumper cables will be attached to materials being handled by boom equipment when electrical charge may be induced while working near energized transmitters. Crews will be provided nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load. Insulating gloves will be used.

- Continue to watch overhead power lines. Both hoist lines and overhead power lines can be moved toward each other by the wind.

- If there are any questions concerning drill rig operations on a site in the vicinity of overhead power lines, call the power company. The power company will provide expert advice as a public service.

- Look for warning signs indicating underground utilities. Underground utilities may be located a considerable distance away from the warning sign. Call the utility and jointly determine the precise location of all underground utility lines, mark and flag the locations and determine the specific precautions to be taken to ensure safe drilling operations.

Wire Rope Safety

- All wire ropes and fittings will be visually inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware.

- Wire ropes must be replaced when inspection indicates excessive damage. The Wire **Rope User's Manual** may be used as a guide for determining excessive damage.

- Wire ropes that have not been used for a period of a month or more will be thoroughly inspected before being returned to service.

- All manufactured and end fittings and connections must be installed according to the manufacturer's specifications.

- Swivel bearings on ball-bearing type hoisting swivels must be inspected and lubricated daily to ensure that the swivel rotates freely under load.

- Do not drill through or rotate drill through a slipping device, do not hoist more that 10 feet of the drill rod column above the top of the last (mast), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool hoists while the rod column is being supported by a rod slipping device.

- Do not attempt to brake the fall of a drill rod column with your hands or by increasing tension on the rod slipping device.

- Wire ropes must be properly matched with each sheave. The sheave will pinch wire rope that is too large. Wire rope that is too small will groove the sheave. Once a sheave is grooved, it will severely pinch and damage larger sized wire rope.

- Use tool handling hoists only for vertical lifting of tools. Do not use tool handling hoists to pull on objects away from the drill rig.

- All hoisting hooks will be equipped with safety latches.

- When tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull for the hoist line or the feed mechanism of the drill.

- Minimize shock loading of a wire rope; apply loads smoothly and steadily.

- Avoid sudden loading in cold weather.

- Never use frozen ropes.

- Protect wire rope from sharp corners or edges.

- Replace faulty guides and rollers.

- Replace worn sheaves or worn sheave bearings.

- Know the safe working load of the equipment and tackle. Never exceed safe working limits.

- Periodically inspect clutches and brakes of hoists.

- Always wear gloves when handling wire ropes.

- Do not guide wire rope onto hoist drums with your hands.

- After installation of a new wire rope, the first lift must be a light load to allow the wire rope to adjust.

- Never leave a load suspended when the hoist is unattended.

- Never use a hoist line to ride up the mast.

Cathead and Rope Hoist Safety

- Keep the cathead clean and free of rust and oil and/or grease. The cathead must be cleaned with a wire brush when it becomes rusty.

- Check the cathead for rope wear grooves. If a rope groove forms that is deeper that ⅛ inch, the cathead must be replaced.

- Always start work with a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast. If the rope grabs the cathead or otherwise becomes tangled in the drum, release the rope and sound the alarm for all personnel to clear the area rapidly.

- The rope must not be permitted to contact chemicals.

- Never wrap the rope from a cathead around a hand, wrist, arm, foot, ankle, leg, or any other body part.

- Attach the hammer to the rope using a knot that will not slip such as a bowline.

- A minimum of 18 inches must be maintained between the operating hand and the cathead drum when driving samplers, casing, or other tools. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground. Loosen grip on the rope as the hammer falls. Maintaining a tight grip on the rope increases the chances of being pulled into the cathead.

- Do not use a rope that is longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the operating cathead rope.

- The cathead operator must be on a level surface with good, firm footing conditions.

Auger Safety

- The drill rig must be level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM when starting an auger boring.

- Seat the auger head below the ground surface with an adequate amount of downward pressure prior to rotation.

- Observe the auger head while slowly engaging the clutch or rotation control and start rotation. Stay clear of the auger.

- Slowly rotate the auger and auger head while continuing to apply downward pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below the surface.

- Follow manufacturer's recommended methods for securing the auger to the power coupling.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never place feet under the auger section that is being hoisted.

- Stay clear of rotating augers and other rotating components of the drill rig.

- Never reach behind or around a rotating auger.

- Use a long-handle shovel to move auger cuttings away from the auger.

- Augers will be cleaned only when the drill rig is in neutral and the augers have stopped rotating.

Rotary and Core Drilling Safety

- Water swivels and hoist plugs must be lubricated and checked for frozen bearings before use.

- Drill rod chuck jaws must be checked periodically and replaced as necessary.
- The weight of the drill rod string and other expected hoist loads must not exceed the hoist and sheaves capacities.
- Only the operator of the drill rig will brake or set a manual chuck to ensure that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- The drill rod chuck jaws will not be used to brake drill rods during lowering into the hole.
- Drill rods will not be held or lowered into the hole with pipe wrenches.
- Do not attempt to grab falling drill rods with hands or wrenches.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction must be relieved or bled down prior to breaking the first tool joint.
- Use a rubber or other suitable rod wiper to clean rods during removal from the hole. Do not use hands to clean drilling fluids from the drill rods.
- Do not lean unsecured drill rods against the mast.

Attachment C

Health and Safety Plan Forms

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site and returned to: EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: CTO — 106

Contract No: N62467-89-D-0318

Project: SWMU 38 — Miscellaneous Ditches in Industrial Areas (Southside)

I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

____

Signed

____

Print Name

____

Company

____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: ____

Job Name: ____

Date(s) From/To: ____

Hours On Site: ____

Contaminants (Suspected/Reported):

____

____

____

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____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)

NAME OF INJURED OR ILL WORKER AND COMPANY
WORKER'S SOCIAL SECURITY NUMBER

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐	LOST WORK DAY WITH _____DAYS AWAY FROM WORK	LOST WORK DAY WITH _____DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY ☐ FIRST-AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR (Print)	TITLE
	DATE

Attachment D

Directions to Emergency Medical Facilities

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

The nearest hospital **and** the nearest facility capable of treating chemical burns are the same facility, which is located at Methodist North Hospital. Therefore, there is only one set of directions.

Nearest Hospital **Methodist North Hospital** **3960 Covington Pike** **Memphis, Tennessee** **Emergency Room Telephone Number — (901) 372-5211**

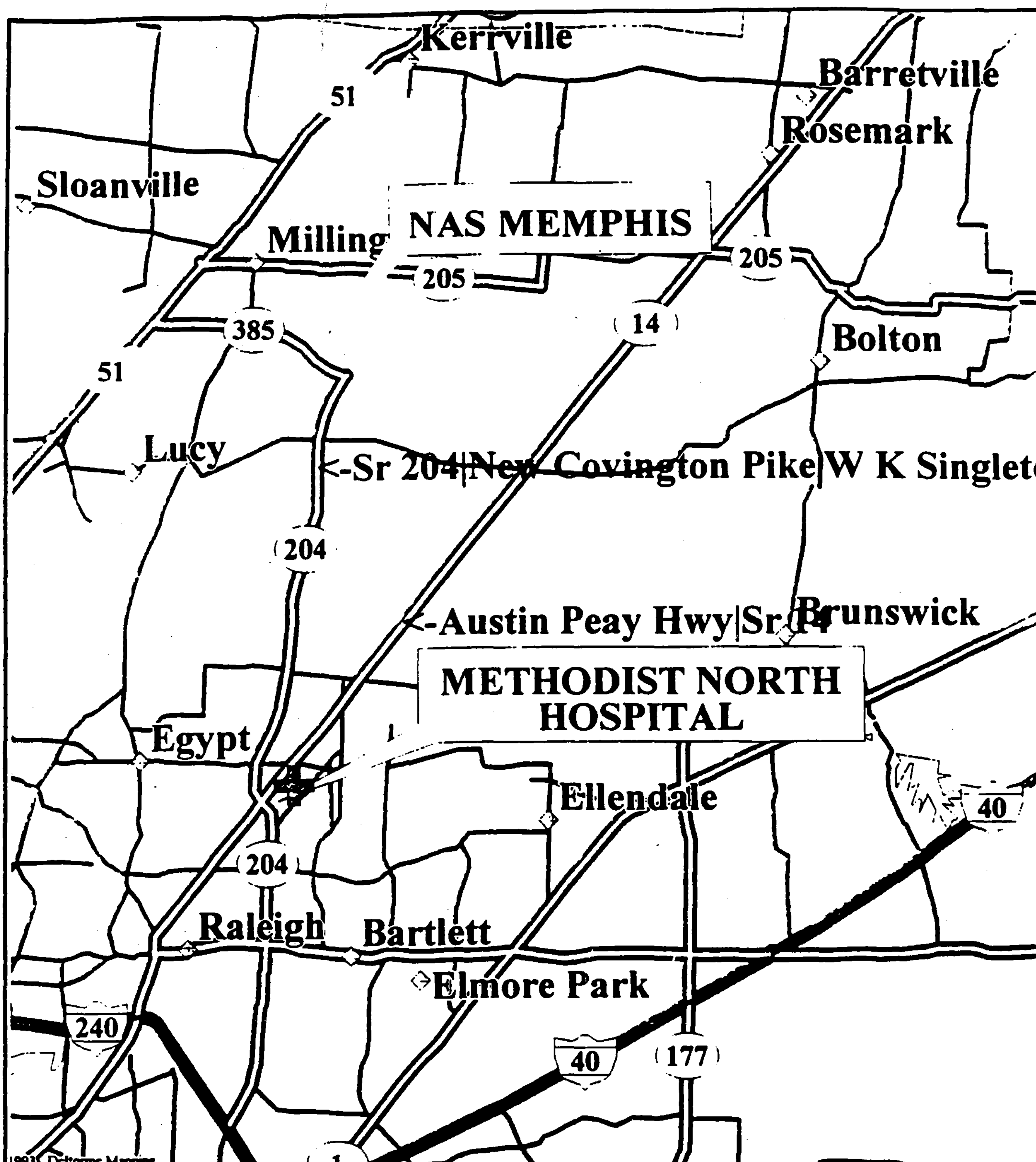
Directions to Methodist North Hospital from NAS Memphis Main Gate:

1) Exit site through South Gate (Singleton Parkway).

2) Continue on Singleton Parkway through the stop signs.

3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).

4) You will see the entrance to the emergency room 700 feet past this light on the left.



HEALTH & SAFETY PLAN
NAS MEMPHIS
MILLINGTON, TN

DIRECTIONS TO THE HOSPITAL

DWG DATE: 10/04/94 | DWG NAME: BOARD

ASSEMBLY E — RFI WORK PLAN
NAVAL AIR STATION MEMPHIS

SITE INVESTIGATION PLAN
SWMU 38
MISCELLANEOUS DITCHES IN INDUSTRIAL AREAS (SOUTHSIDE)

CTO-106
Contract No. N62467-89-D-0318

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

EnSafe/Allen & Hoshall
5720 Summer Trees Drive, Suite 8
Memphis, Tennessee 38134
(901) 383-9115

September 20, 1995

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1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long Term Environmental Action Navy Program, the following RCRA Facility Investigation (RFI) Site Investigation Plan has been prepared for SWMU 38, Miscellaneous Ditches in Industrial Areas, on the Southside of NAS Memphis, Millington, Tennessee. The primary reference for this plan is the *Comprehensive RFI Work Plan* (E/A&H, 1994).

2.0 ENVIRONMENTAL SETTING

In its entirety, SWMU 38 covers most of the open ditches on NAS Memphis. The SWMU 38 ditches are used to drain the north and south sides of NAS Memphis; however, only the ditches which lie on the Southside of the base are included in this investigation. SWMU 38 on the NAS Memphis Southside is shown in Figure 1.

Several drainage ditches have been included in other investigations at NAS Memphis, including SWMU 5 (Assembly A - Aircraft Fire Fighting Training Area); SWMUs 4, 6, 10, 31, and 38 (Assembly B Northside Drainage Ditches), and SWMUs 2 and 14 (Assembly E - Southside Landfill and Former Site of Building S-140 and Seventh Avenue Ditch, respectively).

The original design of many buildings at NAS Memphis (circa 1943) provided for floor drains which discharged to storm sewers, storm drains, and drainage ditches. As buildings were remodeled and replaced, these drains were eliminated or re-routed to the sanitary sewer. Until 1980, when most of these drains were replaced, it is reported that various substances, including solvents, degreasers, oils, and paints, may have been discharged to the drainage ditches. The 1990 RFA description for SWMU 38 (ERC/EDGe, 1990) is provided in Attachment 1 of this document.

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Figure 1 Vicinity Map

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2.1 Topography and Drainage

The general topography of the SWMU 38 area consists of a subtle downward slope to the west of approximately 1 to 3%. Ditches comprising SWMU 38 drain to the Big Creek Drainage Canal in the southwest corner of NAS Memphis. Water stages in the ditches may vary as much as several feet during storm events. The ditches appear to have been eroded in several areas. A topographic map showing local land surface elevations for SWMU 38 is provided as Attachment 2 of this document.

2.2 Geologic and Hydrogeologic Information

The regional and local hydrogeology are described in Sections 2.11 and 2.12, respectively, of the *Comprehensive RFI Work Plan*. Site-specific geologic and hydrogeologic information has been collected from the following sources:

- Several stratigraphic test borings completed on the NAS Memphis Southside, including two test holes recently completed by the United States Geological Survey (USGS).

- Subsurface information generated during the installation of two background well clusters, designated BG-02 and BG-04, on the Southside.

The following sections describe the geologic and hydrogeologic information for NAS Southside.

2.2.1 Stratigraphic Test Borings

Stratigraphic Test Hole SH:U-89, near the west central base boundary, was drilled logged in 1983 in preparation for installing Southside production well PW-5 in 1985. The U.S. Geological Survey (USGS) recently completed two soil borings on the Southside, designated as Test Holes 7 and 8 (Figure 1). Test Hole 7 is approximately 75 feet north of SWMU 14 and Test Hole 8 is at the south corner of the sewage lagoon (SWMU 9) near Big Creek. Table 1 describes the lithology encountered at each stratigraphic test hole. As shown on Table 1, lithology in the upper interval of the test borings differs from north to south and west to east. Instead of loess and fluvial deposits, alluvium is present in the stratigraphic test boring nearest to Big Creek (Test Hole 8). In addition, when comparing Test Hole SH:U-89 to Test Holes 7 and 8, the fluvial deposits are thinner and the Cockfield Formation thicker in the eastern part of the Southside. A copy of the boring log for SH:U-89 is included in Attachment 3 of this document.

Table 1
Stratigraphic Test Borings on the NAS Memphis Southside

Stratigraphic Unit	SH:U-89[a,b]	Test Hole 7 (SH:V-79)	Test Hole 8 (SH:V-80)
Alluvium	Not present	Not present	Clayey silt 0-35 feet bls[c], sand and gravel 35-45 feet bls (45')[d]
Loess	Silt and clay deposits 0 to 38 feet bls (38')	Silt and clayey silt 0 to 34 feet bls (34')	Not present
Fluvial Deposits	Sand and gravel 38 to 97 feet bls (59')	Sand, gravel, and silt 34 feet bls to 47 feet bls (13')	Not present
Cockfield Formation	Sand, silt, clay, and lignite 97 feet bls to 134 feet bls (37')	Sand, silt, clay, and lignite from 47 feet bls to 173 feet bls (126')	Sand, silty sand, clay, and lignite 45 to 153 feet bls (108')
Cook Mountain Formation	Hard clay and silt from 134 feet bls to 160 feet bls (26'); confining unit for the Memphis Aquifer	Hard slightly silty clay from 173 feet bls to termination depth of boring at 202 feet; confining unit for the Memphis Aquifer	Hard slightly silty clay from 153 feet bls to termination depth of boring at 182 feet bls; confining unit for the Memphis Aquifer

Notes:

[a] SH:U-89 - USGS well designations
[b] Lithologic description for U-89 based on driller's log contained in Attachment 3. Lithologic descriptions for Test Holes 7 and 8 based on oral communication with USGS representatives; geophysical logs are forthcoming in USGS publications.
[c] bls - below land surface
[d] (38') - indicates thickness of formation

The USGS collected soil samples from USGS Test Holes 7 and 8 and submitted them for geotechnical analyses (J. Carmichael, USGS, written communication, 1995). Table 2 presents the hydraulic conductivity results of the soil samples.

Table 2
Hydraulic Conductivity Analyses: USGS Test Holes 7 and 8

Test Hole	Sample Depth (feet bls[a])	Hydraulic Conductivity[b]
TH-7	10 - 12	2.83×10^{-7}
TH-7	160 - 162	1.04×10^{-7}
TH-7	200 - 201.5	3.48×10^{-7}
TH-8	17 - 19.5	2.41×10^{-6}
TH-8	180 - 182.5	1.76×10^{-9}

Notes:

[a] bls denotes below land surface
[b] Hydraulic conductivity determined using the following method: triaxial, constant head, undisturbed method; data reported in centimeters per second. Results obtained through written communication with Mr. Jack Carmichael of USGS

2.2.2 Background Well Clusters Number 2 and 4

Two background well clusters, designated BG-02 and BG-04, were installed on the Southside in January, 1995, in conjunction with the RFIs at Assembly A SWMUs. Figure 1 shows the background well locations, and Attachment 3 of this document contains the boring logs. The following table describes the lithology encountered at each background well location.

Table 3
Background Wells on the NAS Memphis Southside

Stratigraphic Unit	BG-02	BG-04
Alluvium	Not present	Not present
Loess	Silt and clay deposits 0 to 29 feet bls (29')	Silt and clayey silt 0 to 38 feet bls[a] (38')[b]
Fluvial Deposits	Sand and gravel 29 to 77 feet bls (48')	Sand, gravel, and silt 38 feet bls to 71 feet bls (33')
Cockfield Formation	Sand, silt, and clay 77 feet bls to termination depth of the boring at 87 feet bls	Sand and clay from 71 feet bls to termination depth of the boring at 76 feet bls

Notes:

[a] bls = below land surface
[b] (29') - indicates thickness of formation

The lithology encountered at background well locations BG-02 and BG-04 was similar to that of stratigraphic test hole SH:U-89 and Test Hole 7 described above; however, the fluvial deposits at BG-02 were thicker (38 feet) than at Test Hole 7 (13 feet).

2.2.3 Shallow Groundwater

Based on existing regional information, depth to groundwater is expected to range between approximately 10 and 15 feet below land surface (bls). Based on topography and the information contained in the conceptual model of the NAS Memphis hydrogeology (Section 2.12 of the *Comprehensive RFI Work Plan*), groundwater is presumed to flow in a southwesterly direction in the fluvial deposits/deeper alluvium in the vicinity of the SWMU 38 ditches. Within the NAS Memphis Southside, groundwater in the loess/shallow alluvium most likely moves primarily downward to recharge the fluvial deposits/deeper alluvium. In the immediate vicinity of SWMU 38, some water in the loess/alluvium may move laterally to discharge to the ditches.

2.3 Climatological Data

Regional climatological data are provided in Section 2.8 of the *Comprehensive RFI Work Plan.*

3.0 SOURCE CHARACTERIZATION

The drainage ditches in the industrial areas on the Southside reportedly have received a variety of wastes from 1943 to 1980 through the building floor drains that were piped to the ditches. By of 1980, most of the floor drains had been plugged or re-piped to discharge to the sanitary sewer. The wastes received by the ditches now are restricted to stormwater runoff and various outfalls which are permitted through the NPDES permit program.

Surface water runoff and the numerous outfalls from the Southside also discharge into SWMU 38. Most wastes discharged into the drainage ditches prior to 1980 would have been transported downstream during flow events. However, due to their relative immobility, some residual metals may be in accumulated soil and sediment nearest the outfalls.

4.0 CHARACTERIZATION OF HAZARDOUS CONSTITUENT RELEASES

4.1 Previous Investigations

This area has not been previously studied.

4.2 Data Gaps

This proposed investigation will address the potential for contamination of sediments in SWMU 38 due to past disposal practices associated with the various industrial operations on the Southside.

4.3 Objective and Proposed Field Investigation

The proposed field investigation is designed to delineate the horizontal and vertical extent of any sediment/soil contamination present at SWMU 38. The investigation will begin with a sediment/soil sampling phase as described below. All sample collection and processing will be in accordance with Section 4 of the *Comprehensive RFI Work Plan*.

Contaminant concentrations identified in sediments within SWMU 38 on the Southside will be compared to concentrations in the five background soil borings installed across the base, results from upstream sediment sample locations, and to soil concentrations at other SWMUs. These comparisons will assist in determining whether measured values occur naturally or indicate contamination. Samples of these mediums also will be compared to the appropriate action levels to determine if further investigation and remediation are necessary. All samples will be submitted for full-scan analysis (FSA) using the following methods:

Analysis	*Method*
Volatile Organic Compounds	USEPA Method 8240
Semivolatile Organic Compounds	USEPA Method 8270
Total Petroleum Hydrocarbons - Gasoline and Diesel-Range Organics	TN Modified 8015 - GRO.BTEX/DRO

Analysis	*Method*
Chlorinated Pesticides/PCBs	USEPA Method 8080
Organophosphorus Pesticides	USEPA Method 8140
Chlorinated Herbicides	USEPA Method 8150
40 CFR Pt. 264, Appendix IX Metals	USEPA Method 6010/7000 series
Total Cyanide	USEPA Method 9010

Reference materials will be used to determine the physical, chemical, and migration/dispersal characteristics of any contaminants identified during the RFI that exceed the appropriate action levels. The procedures and references used to determine these characteristics will be documented in the RFI report.

4.3.1 Sediment/Soil Sampling

The proposed investigation will consist of collecting two sediment/soil samples at 16 locations within SWMU 38 (Figure 2). Sixteen shallow (0 to 6 inches bls) samples will be collected to capture any recently deposited contaminants and 16 deeper (18 to 24 inches bls) samples will be collected to capture any contaminants from past releases. These sample locations have been selected to ensure that each branch leading to the main channel of the drainage system is adequately characterized. Two of the sediment/soil sample locations are proposed at the upper (northern) end of the eastern and western portions of the SWMU 38 drainage ditches to provide upstream sediment/soil concentrations that are least affected by industrial influences (Figure 2). Samples collected in the main channel are located downstream of each confluence to determine if contaminants have been transported by discharge or runoff into these ditches from the upstream sites. Samples will be collected with stainless-steel trowels, hand-augers, or push-tube samplers using procedures outlined in Sections 4.4.3 and 4.7.2 of the *Comprehensive RFI Work Plan*. If any areas of contamination are found or suspected, additional samples will be collected.

Field personnel may deviate from this sampling strategy should field conditions or data suggest that changing the sampling location, interval, or frequency would yield more useful information. Any deviations will be recorded in the field logbook along with an explanation for each deviation.

4.3.2 Expansion of Investigation

The investigation may be expanded to determine the horizontal and vertical extent of contamination based on an evaluation of the following:

- Analytical results of soil/sediment samples which exceed two times background concentrations for soil samples at the activity.

- Analytical results of soil/sediment samples which exceed concentrations in upstream soil/sediment samples (refer to Section 4.3.1).

- Analytical results of soil/sediment samples which exceed preliminary remediation goals.

If necessary, groundwater and/or ecological concerns will be addressed in this phase of the investigation.

4.4 Analytical Requirements

Approximately 32 sediment/soil samples will be collected with a hand auger, trowel, or push-tube sampler. Each sample will be submitted to an offsite laboratory for FSA. Level III-equivalent Data Quality Objectives (DQO) will be used for 95% of the samples and

Level IV-equivalent for the remaining 5%. The FSA analytical parameters are detailed in Appendix F of the *Comprehensive RFI Work Plan.* Field sampling personnel will determine which samples will receive a Level IV-equivalent DQO.

4.5 Sample and Data Management

Sample management procedures will adhere to Section 4.12 of the *Comprehensive RFI Work Plan.*

4.6 Sample Custody

Sample custody will adhere to Section 4.12.5 of the *Comprehensive RFI Work Plan.*

4.7 Quality Assurance/Quality Control

Quality assurance/quality control procedures to be followed during the investigation will adhere to Section 4.14 of the *Comprehensive RFI Work Plan.*

4.8 Decontamination Procedures

Decontamination procedures will adhere to Section 4.11 of the *Comprehensive RFI Work Plan.*

4.9 Investigation-Derived Waste

Investigation-derived waste will be handled as specified in Section 4.13 of the *Comprehensive RFI Work Plan.* E/A&H is currently preparing a detailed *Investigation-Derived Waste Management Plan* for NAS Memphis. This plan, which will be submitted prior to the Assembly E field activities, provides additional guidance for handling IDW generated during the Assembly E RFI.

5.0 POTENTIAL RECEPTORS

The SWMU addressed in this investigation transects the Southside of NAS Memphis. All of the drainage ways are located in populated areas of the base; therefore, the potential exists for contact with surface water and sediment in these features by base personnel. Off base, the potential also exists for similar contact by the general public due to unrestricted access to the Big Creek Drainage Canal. According to base personnel, no fishing or swimming occurs in the Big Creek Drainage Canal, but children may play near it. Big Creek and its tributaries also provide a source of water from which animals drink and/or feed.

Other potential receptors include two production wells (PW-4 and PW-5) (Figure 1). PW-4 is in the northwest corner of the southern side of NAS Memphis approximately 500 feet northeast of the northern end of the western portion of SWMU 38. PW-5 is approximately 1,300 feet south of PW-4 and 500 feet east of the western portion of SWMU 38. Both production wells are screened in the Fort Pillow Aquifer (PW-4 is screened at a depth of 1,450 feet bls and PW-5 is screened at a depth of 1,435 feet bls), with the Flour Island confining unit above the screened intervals. The potential for ecological and human health effects will be analyzed in more detail and presented in the RFI report if contamination is found at SWMU 38.

6.0 QUALITY ASSURANCE PLAN

The Quality Assurance Plan presented in Section 4.14 of the *Comprehensive RFI Work Plan* will be followed throughout the RFI.

7.0 DATA MANAGEMENT PLAN

The Data Management Plan presented in Section 5.0 of the *Comprehensive RFI Work Plan* will be followed during the RFI.

8.0 HEALTH AND SAFETY PLAN

The site-specific Health and Safety Plan for SWMU 38 is included in Appendix A of this document. The comprehensive health and safety plan is included in Section 7.0 of the *Comprehensive RFI Work Plan*.

9.0 REFERENCES

EnSafe/Allen & Hoshall (1995). *Final Groundwater Monitoring Well Management Plan, Phase I, Naval Air Station Memphis*. Revision 1, E/A&H: Memphis, Tennessee.

EnSafe/Allen & Hoshall (October 1994). *Comprehensive RFI Work Plan for Naval Air Station Memphis*. E/A&H: Memphis, Tennessee.

ERC/EDGe (September 1990). *RCRA Facility Assessment (RFA), NAS Memphis*. ERC/EDGe: Nashville, Tennessee.

Southern Division Naval Facilities Engineering Command (May 1990). *Draft Final RCRA Facility Investigation Work Plan for Naval Air Station-Memphis*. SOUTHDIV: Charleston, South Carolina.

United States Geological Survey (1995). Oral and written communication with Mr. Jack Carmichael. USGS: Nashville, Tennessee.

Appendix A

Site-Specific Health and Safety Plan

Hasp
14

Attachment A

Material Safety Data Sheets

CHEMTOX DATA

---------- IDENTIFIERS ----------

CHEMTOX RECORD 445 LAST UPDATE OF THIS RECORD: 06/03/93

NAME: ACETONE

SYNONYMS: ACETON (German, Dutch, Polish); ACETONE ; DIMETHYLFORMEHYDE; DIMETHYLKETAL; DIMETHYL KETONE; KETONE, DIMETHYL; KETONE PROPANE; beta-KETOPROPANE; METHYL KETONE; PROPANONE; 2-PROPANONE; PYROACETIC ACID; PYROACETIC ETHER; DIMETHYLFORMALDEHYDE

CAS: 67-64-1 RTECS: AL3150000

FORMULA: C3H6O MOL WT: 58.08

WLN: 1V1

CHEMICAL CLASS: Ketone

See other identifiers listed below under Regulations.

---------- PROPERTIES ----------

PHYSICAL DESCRIPTION: colorless liquid with a fragrant, mint-like odor

BOILING POINT:	329.27 K	56.1 C	133 F
MELTING POINT:	178.9 K	-94.3 C	-137.7 F
FLASH POINT:	255.32 K	-17.83 C	-.1 F
AUTO IGNITION:	738 K	464.8 C	868.8 F
CRITICAL TEMP:	508 K	234.85 C	454.73 F
CRITICAL PRESS:	4.70 kN/M2	46.3 atm	680 psia
HEAT OF VAP:	220 Btu/lb	122.18 cal/g	5.112x E5 J/kg
HEAT OF COMB:	-12250 Btu/lb	-6810 cal/g	-285x E5 J/kg

VAPOR PRESSURE:	196 mm @ 21 C
UEL:	12.8 %
LEL:	2.6 %
IONIZATION POTENTIAL (eV):	6.87 TO 7.19
VAPOR DENSITY:	2 (air=1)
EVAPORATION RATE:	6.06(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.791 @ 20 C
DENSITY:	0.791
WATER SOLUBILITY:	MISCIBLE
INCOMPATIBILITIES:	ox, acids
REACTIVITY WITH WATER:	No reaction
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	100 ppm
ODOR DESCRIPTION:	residual; ketonic, pleasant, non-residual Source:CHRIS

100 % ODOR DETECTION: 300 ppm

REGULATIONS

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1090
DOT shipping name:	Acetone
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T8
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER: 4908105

CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	U002,D001
CERCLA REF:	Y
RQ DESIGNATION:	D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE:	Not listed

SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Not given
Mailability: Nonmailable
Max per parcel: 0

NFPA CODES:
HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACETONE [67-64-1]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 313 Toxic Chemicals List
Second Third Wastes List. 40 CFR 268.11. 54 FR 26594 (June 23, 1989)
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

----------------------------- TOXICITY DATA -----------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 300 ppm have caused irritation of eyes, nose and throat. levels of 500 to 1,000 ppm for 6 hours have caused, in addition, general weakness and heaviness of the eyelids. exposures of 12,000 ppm for a few minutes may cause weakness in arms and legs and fainting. 20,000 ppm may be fatal on brief exposure. SKIN: liquid acetone may cause drying of the skin, irritation, redness, and an increased chance of infection. Eyes: irritation has been reported at 500 ppm after 3-6 hours. splashes into the eye may result in swelling, irritation, damage to the cornea and blindness. INGESTION: 20 ml (2/3 fluid ounce) may result in excess salivation, nausea, vomiting, stomach pain and possible liver and kidney damage. 200 ml (7 fluid ounces) has resulted in these symptoms and, additionally, swelling of the throat, sores in the mouth and throat, shallow breathing and coma. although 200 ml has been survived with prompt medical attention, death may occur from as little at 100 ml (three and one half fluid ounces).(NYDH)

LONG TERM TOXICITY: levels of 500 to 1,000 ppm can produce eye irritation

after 3 hours. daily exposures at this level have resulted in irritation of throat and lungs, dizziness, and inflammation of stomach and intestines.(NYDH)

TARGET ORGANS:	respiratory system, skin, eyes, CNS
SYMPTOMS:	INHALATION: vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations. INGESTION: low order of toxicity but very irritating to mucous membranes. SKIN: prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis. Source: CHRIS
CONC IDLH:	2500PPM
NIOSH REL:	250 ppm Time weighted averages for 8-hour exposure 590 mg/M3 Time weighted averages for 8-hour exposure
ACGIH TLV:	TLV = 750ppm(1780 mg/M3)
ACGIH STEL:	STEL = 1000 ppm(2380 mg/M3)
OSHA PEL:	Transitional Limits: PEL = 1000 ppm(2400mg/M3) Final Rule Limits: TWA = 750 ppm (1800 mg/M3) STEL = 1000 ppm(2400 mg/M3) STEL DOES NOT APPLY TO THE CELLULOSE ACETATE FIBER INDUSTRY.
MAK INFORMATION:	500 ppm 1200 mG/M3 Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.
CARCINOGEN?:	N STATUS: See below
CARCINOGEN LISTS:	IARC: Not listed MAK: Not listed NIOSH: Not listed NTP: Not listed ACGIH: Not listed OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-man TDLo:2857 mg/kg 34ZIAG -,64,69
  BEHAVIORAL
    Coma
  KIDNEY,URETER,BLADDER
    Other changes

orl-man TDLo:2857 mg/kg DIAEAZ 15,810,66
  BEHAVIORAL

Coma
BIOCHEMICAL
Metabolism
Other

ihl-man TCLo:440 ug/m3/6M GISAAA 42(8),42,77
BRAIN AND COVERINGS
Recordings from specific areas of CNS

ihl-man TCLo:10 mg/m3/6H GISAAA 42(8),42,77
BIOCHEMICAL
Metabolism
Other carbohydrates

ihl-hmn TCLo:500 ppm JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

ihl-man TCLo:12000 ppm/4H AOHYA3 16,73,73
GASTROINTESTINAL
Nausea or vomiting
BEHAVIORAL
Muscle weakness

LD50 value: orl-rat LD50:5800 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5800 mg/kg
ihl-rat LC50:50100 mg/m3/8H
ipr-rat LDLo:500 mg/kg
ivn-rat LD50:5500 mg/kg
orl-mus LD50:3 gm/kg
ihl-mus LCLo:110 gm/m3/1H
ipr-mus LD50:1297 mg/kg
ivn-mus LDLo:4 gm/kg
orl-dog LDLo:8 gm/kg
ipr-dog LDLo:8 gm/kg
scu-dog LDLo:5 gm/kg
orl-rbt LD50:5340 mg/kg
skn-rbt LD50:20 gm/kg
ivn-rbt LDLo:1576 mg/kg
skn-gpg LD50:>9400 mg/kg
scu-gpg LDLo:5 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 500 ppm
skn-rbt 395 mg open MLD
eye-rbt 3950 ug SEV

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:273 gm/kg (13W male) NTIS** PB91-185975
PATERNAL EFFECTS
Spermatogenisis

California Prop 65: Not listed

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Acetone; CASRN 67-64-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Acetone
CASRN -- 67-64-1
Last Revised -- 12/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on lack of data concerning carcinogenicity in humans or animals.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

None.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Acetone did not show mutagenic activity when tested in Salmonella typhimurium strains TA98 and TA100 or in Schizosaccharomyces pombe strain P1 either in the presence or absence of liver homogenates (McCann et al., 1975; Abbondandolo et al., 1980; Maron et al., 1981; Hallstrom et al., 1981) or in cell transformation systems (Freeman et al., 1973; Rhim et al., 1974; Quarles et al., 1979a,b). Furthermore, acetone gave negative results in assays for chromosomal aberrations and sister chromatid exchange (Norppa et al., 1981; Norppa, 1981; Tates and Kriek, 1981), DNA binding (Kubinski et al., 1981), point mutation in mouse lymphoma cells (Amacher et al., 1980), and transfection of E. coli CR63 cells (Vasavada and Padayatty, 1981). In one study, however, acetone was reported to produce chromosomal aberrations but not sister chromatid exchanges (Kawachi et al., 1980).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1988. Updated Health Effects Assessment for Acetone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and

Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 updated Health Effects Document for Acetone has received Agency review and is approved for publication.

Agency Work Group Review: 12/06/89

Verification Date: 12/06/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charles Ris / ORD -- (202)260-5895 / FTS 260-5898

---------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister or air-supplied mask; synthetic rubber gloves; chemical safety goggles or face splash shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (ACETONE)
1000 ppm: Any chemical cartridge respirator with organic vapor cartridge(s). / Any powered air-purifying respirator with organic vapor cartridge(s). / Any supplied-air respirator. / Any self-contained breathing apparatus.
6250 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require

eye protection.
12500 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece.
20000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: flush with water immediately for at least 15 min. consult a physician.
SKIN: wash well with water.
INHALATION: if victim overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: seek immediate medical attention

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: if victim has swallowed large amounts and is conscious and not having convulsions, induce vomiting and get medical help promptly; no specific antidote known.
SKIN: wash well with water.
EYES: flush with water immediately for at least 15 min. Consult a physician.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE -----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, carbon dioxide. Note: Water in straight hose stream will scatter and spread fire and should not be used. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Acetone

DOT ID NUMBER: UN1090

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.

*HEALTH HAZARDS

May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 1843 LAST UPDATE OF THIS RECORD: 06/03/93

NAME: PETROLEUM SPIRITS

SYNONYMS: BENZINE; BENZOLINE; CANADOL; HERBITOX; LIGROIN; MINERAL SPIRITS; MINERAL SPIRITS NO. 10; MINECAL THINNER; MINERAL TURPENTINE; NAPHTHA, V.M. AND P.; PAINTERS' NAPHTHA; REFINED SOLVENT NAPHTHA; SOLVENT NAPHTHA

CAS: 8030-30-6 RTECS: SE7555000

FORMULA: W99 MOL WT:

WLN: A10-15

CHEMICAL CLASS: Paraffin

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: reddish-brown, mobile liquid with an aromatic odor

BOILING POINT:	NA
MELTING POINT:	NA
FLASH POINT:	Not available
AUTO IGNITION:	Not available
VAPOR PRESSURE:	
UEL:	~
LEL:	~
VAPOR DENSITY:	No data
EVAPORATION RATE:	5.53(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	No data
DENSITY:	
WATER SOLUBILITY:	
INCOMPATIBILITIES:	

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data

TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	No data
100 % ODOR DETECTION:	No data

REGULATIONS

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1271

DOT shipping name:	Petroleum spirit
Packing group:	I - II
Label(s) required:	FLAMMABLE LIQUID - FLAMMABLE LIQUID
Special provisions:	T8■B1,T8
Packaging exceptions:	173.150■150
Non bulk packaging:	173.201■202
Bulk packaging:	173.243■242
Quantity limitations-	
Passenger air/rail:	1 L■5 L
Cargo aircraft only:	30 L■60 L
Vessel stowage:	■E, B
Other stowage provisions:	

STCC NUMBER:	,

CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	D001
CERCLA REF:	Not listed
RQ DESIGNATION:	Not listed
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Fire hazard: flammable.

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Not given
Mailability:	Nonmailable
Max per parcel:	0

NFPA CODES:

HEALTH HAZARD (BLUE):	Unspecified
FLAMMABILITY (RED):	Unspecified
REACTIVITY (YELLOW):	Unspecified
SPECIAL:	Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

Canadian Domestic Substances List
DOT Hazardous Materials Table. 49 CFR 172.101
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
PETROLEUM SPIRITS [8030-30-6]
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste

---------------------------- TOXICITY DATA ----------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS:

SYMPTOMS: Source:

CONC IDLH: 1000PPM

NIOSH REL:

ACGIH TLV: Not listed
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 100 ppm(400 mg/m3 /15Mmg/M3)
Final Rule Limits:
TWA = 100 ppm (400 mg/M3)

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
* ihl-hmn LCLo:3 pph/5M TABIA2 3,231,33

LD50 value: orl-rat LD50:>5 gm/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:>5 gm/kg
ihl-rat LCLo:1600 ppm/6H
ihl-mus LCLo:10600 mg/m3/6H
skn-rbt LD50:>3 gm/kg
ipr-mam LDLo:2500 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (PETROLEUM SPIRITS)
1000 ppm: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
2500 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed.
5000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
10000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: None given
SKIN: None given
INHALATION: None given
INGESTION: None given

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE -----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Petroleum spirit
DOT ID NUMBER: UN1271

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and

water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------ IDENTIFIERS ------------------------------

CHEMTOX RECORD 421 LAST UPDATE OF THIS RECORD: 06/03/93

NAME: XYLENE

SYNONYMS: XYLENE (XYLOL); XYLOL; METHYL TOLUENE; BENZENE, DIMETHYL-; DIMETHYLBENZENE; NCI-C55232; VIOLET 3; XYLOL (DOT); SOCAL AQUATIC SOLVENT 3501

CAS: 1330-20-7 RTECS: ZE2100000

FORMULA: C8H10 MOL WT: 106.18

WLN: 1R X1

CHEMICAL CLASS: Aromatic hydrocarbon

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ------------------------------

PHYSICAL DESCRIPTION: colorless liquid with aromatic odor

BOILING POINT:	412 K	138.8 C	281.9 F
MELTING POINT:	247 K	-26.2 C	-15.1 F
FLASH POINT:	300.35-305.35 K	27.2-32.2 C	80.9-89.9 F
AUTO IGNITION:	736.45-802.05 K	463.3-528.9 C	1357.6-1475.6 F

VAPOR PRESSURE:	6.7 mm @ 21 C
UEL:	7 %
LEL:	1 %
IONIZATION POTENTIAL (eV):	8.56
VAPOR DENSITY:	3.7 (air=1)
EVAPORATION RATE:	0.77(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.861 20C
DENSITY:	0.861 g/cc or 8.0073 lb/gal
WATER SOLUBILITY:	VERY SL SOL
INCOMPATIBILITIES:	strong oxidizers
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	0.05
ODOR DESCRIPTION:	LIKE BENZENE; CHARACTERISTIC AROMATIC Source:CHRIS
100 % ODOR DETECTION:	0.4-20 ppm

------------------------------ REGULATIONS ------------------------------

DOT hazard class: 3 FLAMMABLE LIQUID

DOT guide: 27

Identification number: UN1307
DOT shipping name: XYLENES
Packing group: II
bel(s) required: FLAMMABLE LIQUID
special provisions: T1
Packaging exceptions: 173.150
Non bulk packaging: 173.202
Bulk packaging: 173.242
Quantity limitations-
Passenger air/rail: 5 L
Cargo aircraft only: 60 L
Vessel stowage: B
Other stowage provisions:

STCC NUMBER: 4909350, 4909351

CLEAN WATER ACT Sect.307:No
CLEAN WATER ACT Sect.311:Yes
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): 10 mg/L (07/30/92)
Maximum Contaminant Level Goals (MCLG): 10 mg/L (07/30/92)
CLEAN AIR ACT: CAA '90 Listed
EPA WASTE NUMBER: U239,D001
CERCLA REF: Not listed
RQ DESIGNATION: C 1000 pounds (454 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.
Chronic toxicity: carcinogen
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Not given
Mailability: Nonmailable
Max per parcel: 0

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
.lifornia Assembly Bill 1803 Well Monitoring Chemicals.
anadian Domestic Substances List
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 311 Hazardous Chemicals List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989
sconsin Air Toxics Control Regulation NR-445 (December 1988)
.LENE [1330-20-7]

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS:	CNS, eyes, gi tract, blood, liver, kidneys, skin
SYMPTOMS:	DIZZ, EXCITEMENT, DROW, INCO, STAGGERING GAIT, IRRIT EYES, NOSE, THROAT, CORNEAL VACUOLIZATION, ANOREXIA, NAU, VOMIT, ABDOM PAIN; DERM Source: CHRIS
CONC IDLH:	1000ppm
NIOSH REL:	100 ppm Time weighted averages for 8-hour exposure 434 mg/M3 Time weighted averages for 8-hour exposure 200 ppm Ceiling exposures which shall at no time be exceeded(10-MIN) 868 mg/M3 Ceiling exposures which shall at no time be exceeded(10-MIN)
ACGIH TLV:	TLV = 100ppm(435 mg/M3)

ACGIH STEL: STEL = 150 ppm(655 mg/M3)

OSHA PEL: Transitional Limits:
PEL = 100 ppm(435mg/M3)
Final Rule Limits:
TWA = 100 ppm (435 mg/M3)
STEL = 150 ppm(655 mg/M3)

MAK INFORMATION: 100 ppm
440 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
* orl-hmn LDLo:50 mg/kg YAKUD5 22,883,80

ihl-man LCLo:10000 ppm/6H BMJOAE 3,442,70
BEHAVIORAL
General anesthetic
LUNGS, THORAX, OR RESPIRATION
Cyanosis
BLOOD
Other changes

LD50 value: orl-rat LD50:4300 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:4300 mg/kg
ihl-rat LC50:5000 ppm/4H
ipr-rat LD50:2459 mg/kg
scu-rat LD50:1700 mg/kg
ipr-mus LD50:1548 mg/kg
ivn-rbt LDLo:129 mg/kg
ihl-gpg LCLo:450 ppm
ipr-gpg LDLo:2 gm/kg
ipr-mam LDLo:2 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

ACGIH STEL: STEL = 150 ppm(655 mg/M3)

OSHA PEL: Transitional Limits:
PEL = 100 ppm(435mg/M3)
Final Rule Limits:
TWA = 100 ppm (435 mg/M3)
STEL = 150 ppm(655 mg/M3)

MAK INFORMATION: 100 ppm
440 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
* orl-hmn LDLo:50 mg/kg YAKUD5 22,883,80

ihl-man LCLo:10000 ppm/6H BMJOAE 3,442,70
BEHAVIORAL
General anesthetic
LUNGS, THORAX, OR RESPIRATION
Cyanosis
BLOOD
Other changes

LD50 value: orl-rat LD50:4300 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:4300 mg/kg
ihl-rat LC50:5000 ppm/4H
ipr-rat LD50:2459 mg/kg
scu-rat LD50:1700 mg/kg
ipr-mus LD50:1548 mg/kg
ivn-rbt LDLo:129 mg/kg
ihl-gpg LCLo:450 ppm
ipr-gpg LDLo:2 gm/kg
ipr-mam LDLo:2 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

ihl-rat TCLo:250 mg/m3/24H (7-15D preg) ATSUDG 8,425,85
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rat TCLo:50 mg/m3/6H (1-21D preg) JHEMA2 27,337,83
EFFECTS ON FERTILITY
Post-implantation mortality
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)

ihl-rat TCLo:50 mg/m3/6H (1-21D preg) JHEMA2 27,337,83
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Other developmental abnormalities
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

ihl-rat TCLo:600 mg/m3/24H (7-15D preg) PCBRD2
163B,295,85
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

orl-mus TDLo:20600 ug/kg (6-15D preg) JTEHD6 9,97,82
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

orl-mus TDLo:31 mg/kg (6-15D preg) JTEHD6 9,97,82
EFFECTS ON FERTILITY
Post-implantation mortality

ihl-mus TCLo:4000 ppm/6H (6-12D preg) TJADAB 28,22A,83
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)
EFFECTS ON NEWBORN
Physical

ihl-mus TCLo:2000 ppm/6H (6-12D preg) TJADAB 28,22A,83
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-mus TCLo:1 gm/m3/12H (6-15D preg) ATSUDG 8,425,85
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rbt TCLo:500 mg/m3/24H (7-20D preg) ATSUDG 8,425,85
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

California Prop 65: Not listed

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Xylenes; CASRN 1330-20-7 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Xylenes
CASRN -- 1330-20-7
Last Revised -- 03/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are esented in three ways. The slope factor is the result of application of a w-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity.

Basis -- Orally administered technical xylene mixtures did not result in significant increases in incidences in tumor responses in rats or mice of both sexes.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Inadequate. In an NTP (1986) study, 50 male and 50 female F344/N rats were treated by gavage with mixed xylenes in corn oil (60% m-xylene, 14% p-xylene, 9% o-xylene and 17% ethylbenzene) at dosages of 0, 250 or 500 mg/kg/day, 5 days/week for 103 weeks. Similarly, 50 male and 50 female B6C3F1 mice were treated with the same xylene mixture at dosages of 0, 500 or 1000 mg/kg/day. Animals were killed and examined histologically when moribund or after 104-105 weeks. An apparent dose-related increased mortality was observed in male rats, but this difference was statistically significant for the high dose group, only. No other differences in survival between dosage groups of either sex were observed. Interstitial cell tumors of the testes could not be attributed to administration of the test compound observed in male rats (43/50 control, 38/50 low-dose and 41/49 high-dose). NTP (1986) reported that there were no significant changes in the incidence of neoplastic or nonneoplastic lesions in either the rats or mice that could be considered related to the mixed xylene treatment, and concluded that under the conditions of these 2-year gavage studies, there was "no evidence of carcinogenicity" of xylene (mixed) for rats or mice of either sex at any dosage tested.

Maltoni et al. (1985), in a limited study, reported higher incidences (compared with controls) of malignant tumors in male and female Sprague-Dawley rats treated by gavage with xylene in olive oil at 500 mg/kg/day, 4 or 5 days/week for 104 weeks. This study did not report survival rates or specific tumor types; therefore, the results cannot be interpreted.

Berenblum (1941) reported that "undiluted" xylene applied at weekly intervals produced one tumor-bearing animal out of 40 after 25 weeks in skin-painting experiments in mice. No control groups were described. Pound (1970) reported negative results in initiation-promotion experiments with xylene as the initiator and croton oil as the promotor.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

The frequency of sister chromatid exchanges and chromosomal aberrations were nearly identical between a group of 17 paint industry workers exposed to xylene and their respective referents (Haglund et al., 1980). In vitro, xylene caused no increase in the number of sister chromatid exchanges in human lymphocytes (Gerner-Smidt and Friedrich, 1978). Studies indicate that xylene isomers, technical grade xylene or mixed xylene are not mutagenic in tests with Salmonella typhimurium (Florin et al., 1980; NTP, 1986; Bos et al., 1981) nor in mutant reversion assays with Escherichia coli (McCarroll et al., 1981). Technical grade xylene, but not o- and m-xylene, was weakly mutagenic in Drosophila recessive lethal tests. Chromosomal aberrations were not increased in bone marrow cells of rats exposed to xylenes by inhalation (Donner et al., 1980).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1987. Drinking Water Criteria Document for Xylene. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. ECAO-CIN-416. Final.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Drinking Water Criteria Document for Xylene has received Agency and external review.

Agency Work Group Review: 12/02/87

Verification Date: 12/02/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Bruce Mintz / ODW -- (202)260-9569 / FTS 260-9569

W. Bruce Peirano / ORD -- (513)569-7540 / FTS 684-7540

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
OM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes contaminated.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (XYLENE)
1000 ppm: Any chemical cartridge respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation or damage may require eye protection. / Any powered air-purifying respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation · damage may require eye protection. / Any supplied-air respirator. * bstance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash promptly
INHALATION: art resp
INGESTION: no vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with

running water for at least 15 minutes. Wash skin with soap and water.
Remove and isolate contaminated clothing and shoes at the site.

-------------------------- INITIAL INCIDENT RESPONSE -----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: XYLENES
DOT ID NUMBER: UN1307

ERG93 GUIDE 27

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
Material may be transported hot.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.
Stay upwind; keep out of low areas.
›sitive pressure self-contained breathing apparatus (SCBA) and structural fire
.solate for 1/2 mile in all directions if tank, rail car or tank truck is invo
CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping
If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Apply cooling water to sides of containers that are exposed to flames until wel
For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if
Withdraw immediately in case of rising sound from venting safety device or any
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, giv
In case of contact with material, immediately flush eyes with running water for
Remove and isolate contaminated clothing and shoes at the site.

DISCLAIMER: The data shown above on this chemical represents a best effort on

CHEMTOX DATA

---------- IDENTIFIERS ----------

CHEMTOX RECORD 398 LAST UPDATE OF THIS RECORD: 06/03/93

NAME:	TOLUENE		
SYNONYMS:	TOLUOL; PHENYL METHANE; METHYL BENZENE; BENZENE, METHYL-		
CAS:	108-88-3	RTECS:	XS5250000
FORMULA:	C7H8	MOL WT:	92
WLN:	1R		
CHEMICAL CLASS:	Aromatic hydrocarbon		

See other identifiers listed below under Regulations.

---------- PROPERTIES ----------

PHYSICAL DESCRIPTION: colorless watery liquid with a pleasant odor

BOILING POINT:	383.6 K	110.4 C	230.8 F
MELTING POINT:	178.00 K	-95.2 C	-139.3 F
FLASH POINT:	277.6 K	4.45 C	40 F
AUTO IGNITION:	809 K	535.8 C	1488.2 F
CRITICAL TEMP:	591.8 K	318.65 C	605.57 F
CRITICAL PRESS:	4.108 kN/M2	40.5 atm	595 psia
HEAT OF VAP:	155 Btu/lb	86.08 cal/g	3.601x E5 J/kg
HEAT OF COMB:	-17430 Btu/lb	-9690 cal/g	-405x E5 J/kg

VAPOR PRESSURE:	36.7 mm @ 30 C
ˉL:	7.1 %
.L:	1.3 %
IONIZATION POTENTIAL (eV):	8.82
VAPOR DENSITY:	3.14 (air=1)
EVAPORATION RATE:	2.00(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.867 @ 20 C
DENSITY:	0.867
WATER SOLUBILITY:	0.05%
INCOMPATIBILITIES:	strong ox

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data

TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	40 PPM
ODOR DESCRIPTION:	STRONG, PLEASANT Source:NYDH
100 % ODOR DETECTION:	No data

---------- REGULATIONS ----------

DOT hazard class: 3 FLAMMABLE LIQUID

DOT guide:	27
Identification number:	UN1294
DOT shipping name:	Toluene
cking group:	II
abel(s) required:	FLAMMABLE LIQUID
Special provisions:	T1
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER: 4909305

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:Yes
National Primary Drinking Water Regulations
  Maximum Contaminant Levels (MCL): 1 mg/L (07/30/92)
  Maximum Contaminant Level Goals (MCLG): 1 mg/L (07/30/92)

CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U220,D001
CERCLA REF:	Not listed
RQ DESIGNATION:	C 1000 pounds (454 kg) CERCLA
SARA TPQ VALUE:	Not listed

SARA Sect. 312
categories:

Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: adverse effect to target organ after long period of exposure.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.

Fire hazard: flammable.
Chronic toxicity: carcinogen

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:
HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------ SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/90/198904/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Department of Health Services Drinking Water Action List.
California Proposition 65 Developmental Toxin List
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
Clean Water Act Section 311 Hazardous Chemicals List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82
EPA TSCA 8(d) Health and Safety Data Rule - effective date 10/04/82
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
ssachusetts Substance List.
w Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
TOLUENE [108-88-3]
Washington State Discarded Chemical Products List, November 17, 1989
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

---------------------------- TOXICITY DATA ----------------------------------

SHORT TERM TOXICITY: INHALATION: 100 ppm exposure can cause dizziness, drowsiness and hallucinations. 100-200 ppm can cause depression. 200-500 ppm can cause headaches, nausea, loss of appetite, loss of energy, loss of coordination and coma. in addition to the above, death has resulted from exposure to 10,000 ppm for an unknown time. SKIN: can cause dryness and irritation. absorption may cause or increase the severity of symptoms listed above. Eyes: can cause irritation at 300 ppm. INGESTION: can cause a burning sensation in the mouth and stomach, upper abdominal pain, cough, hoarseness, headache, nausea, loss of appetite, loss of energy, loss of coordination and coma.(NYDH)

LONG TERM TOXICITY:	levels below 200 ppm may produce headache, tiredness and nausea. from 200 to 750 ppm symptoms may include insomnia, irritability, dizziness, some loss of memory, loss of appetite, a feeling of drunkeness and disturbed menstruation. levels up to 1,500 ppm may cause heart palpitations and loss of coordination. blood effects and anemia have been reported but are probably due to contamination by benzene. most of these effects area believed to go away when exposure stops.(NYDH)
TARGET ORGANS:	CNS, liver, kidneys, skin, eyes
SYMPTOMS:	Vapors irritate eyes and upper respiratory tract; cause dizziness, headache, anesthesia, respiratory arrest. Liquid irritates eyes and causes drying of skin. If aspirated, causes coughing, gagging, distress, and rapidly developing pulmonary edema. If ingested causes vomiting, griping, diarrhea, depressed respiration. Source: CHRIS
CONC IDLH:	2000ppm
OSH REL:	100 ppm Time weighted averages for 8-hour exposure 375 mg/M3 Time weighted averages for 8-hour exposure 200 ppm Ceiling exposures which shall at no time be exceeded(10-MIN) 750 mg/M3 Ceiling exposures which shall at no time be exceeded(10-MIN)
ACGIH TLV:	TLV = 50ppm(188 mg/M3) Skin
ACGIH STEL:	Not listed
OSHA PEL:	Transitional Limits: PEL = 200 PPM; CEILING = 300 PPM; MAXIMUM PEAK ABOVE CEILIN(Final Rule Limits: TWA = 100 ppm (375 mg/M3) STEL = 150 ppm(560 mg/M3)
MAK INFORMATION:	50 ppm 190 mG/M3 Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours. There is no reason to fear a risk of damage to the developing embryo or fetus when MAK values are adhered to.

CARCINOGEN?: N STATUS: See below

RCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

* orl-hmn LDLo:50 mg/kg YAKUD5 22,883,80

ihl-hmn TCLo:200 ppm JAMAAP 123,1106,43
BRAIN AND COVERINGS
Recordings from specific areas of CNS
BEHAVIORAL
Antipsychotic
BLOOD
Changes in bone marrow not included above

LD50 value: orl-rat LD50:636 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:636 mg/kg
ihl-rat LC50:>26700 ppm/1H
ipr-rat LD50:1332 mg/kg
ivn-rat LD50:1960 mg/kg
unr-rat LD50:6900 mg/kg
ihl-mus LC50:400 ppm/24H
ipr-mus LD50:59 mg/kg
scu-mus LD50:2250 mg/kg
unr-mus LD50:2 gm/kg
ihl-rbt LCLo:55000 ppm/40M
skn-rbt LD50:12124 mg/kg
ivn-rbt LDLo:130 mg/kg
ihl-gpg LCLo:1600 ppm
ipr-gpg LD50:500 mg/kg
scu-frg LDLo:920 mg/kg
ipr-mam LDLo:1750 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:1500 mg/m3/24H (1-8D preg) TXCYAC 11,55,78

EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rat TCLo:1000 mg/m3/24H (7-14D preg) FMORAO 28,286,80
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-rat TCLo:800 mg/m3/6H (14-20D preg) BJMRDK 23,533,90
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON NEWBORN
Behavioral

orl-mus TDLo:9 gm/kg (6-15D preg) TJADAB 19,41A,79
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-mus TDLo:15 gm/kg (6-15D preg) TJADAB 19,41A,79
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

orl-mus TDLo:30 gm/kg (6-15D preg) TJADAB 19,41A,79
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)

ihl-mus TCLo:500 mg/m3/24H (6-13D preg) TXCYAC 11,55,78
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-mus TCLo:1000 ppm/6H (2-17D preg) TJEMDR 7,265,82
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

ihl-mus TCLo:400 ppm/7H (7-16D preg) FAATDF 6,145,86
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system
EFFECTS ON NEWBORN

ihl-mus TCLo:200 ppm/7H (7-16D preg) FAATDF 6,145,86
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

ihl-rbt TCLo:1 gm/m3/24H (7-20D preg) ATSUDG 8,425,85
EFFECTS ON FERTILITY
Abortion

ihl-rbt TDLo:100 ppm/6H (6-18D preg) ARTODN 66,373,92
SPECIFIC DEVELOPMENTAL ABNORMALITIES

Cardiovascular(circulatory)system

California Prop 65: Developmental toxin (01/01/91)
Acceptable intake level-inhalation 13000. ugD (01/01/94)
Acceptable intake level-oral intake 7000. ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY -------------------------
Toluene; CASRN 108-88-3 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Toluene
CASRN -- 108-88-3
Last Revised -- 08/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive e carcinogenicity values found in IRIS. Users are referred to Section I for .formation on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classified

Basis -- No human data and inadequate animal data. Toluene did not produce positive results in the majority of genotoxic assays.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

A chronic (106-week) bioassay of toluene in F344 rats of both sexes reported no carcinogenic responses (CIIT, 1980). A total of 960 rats were exposed by inhalation for 6 hours/day, 5 days/week to toluene at 0, 30, 100, or 300 ppm. Groups of 20/sex/dose were sacrificed at 18 months. Gross and croscopic examination of tissues and organs identified no increase in neoplastic tissue or tumor masses among treated rats when compared with controls. The study is considered inadequate because the highest dose administered was well below the MTD for toluene and because of the high incidence of lesions and pathological changes in the control animals.

Several studies have examined the carcinogenicity of toluene following repeated dermal applications. Toluene (dose not reported) applied to shaved interscapular skin of 54 male mice (strains A/He, C3HeB, SWR) throughout their lifetime (3 times weekly) produced no carcinogenic response (Poel, 1963). One drop of toluene (about 6 mL) applied to the dorsal skin of 20 random-bred albino mice twice weekly for 50 weeks caused no skin papillomas or carcinomas after a 1-year latency period was allowed (Coombs et al., 1973). No increase in the incidence of skin or systemic tumors was demonstrated in male or female mice of three strains (CF, C3H, or CBaH) when toluene was applied to the back of 25 mice of each sex of each strain at 0.05-0.1 mL/mouse, twice weekly for 56 weeks (Doak et al., 1976). One skin papilloma and a single skin carcinoma were reported among a group of 30 mice treated dermally with one drop of 0.2% (w/v) solution toluene twice weekly, administered from droppers delivering 16-20 uL per drop for 72 weeks (Lijinsky and Garcia, 1972). It is not reported whether evaporation of toluene from the skin was prevented during these studies.

_II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Toluene was found to be nonmutagenic in reverse mutation assays with S. typhimurium (Mortelmans and Riccio, 1980; Nestmann et al., 1980; Bos et al., 1981; Litton Bionetics, Inc., 1981; Snow et al., 1981) and E. coli (Mortelmans and Riccio, 1980), with and without metabolic activation. Toluene did not induce mitotic gene conversion (Litton Bionetics, Inc., 1981; Mortelmans and Riccio, 1980) or mitotic crossing over (Mortelmans and Riccio, 1980) in S. cerevisiae. Although Litton Bionetics, Inc. (1981) reported that toluene did not cause increased chromosomal aberrations in bone marrow cells, several Russian studies (Dobrokhotov, 1972; Lyapkalo, 1973) report toluene as effective in causing chromosal damage in bone marrow cells of rats. There was no evidence of chromosomal aberrations in blood lymphocytes of workers exposed to toluene only (Maki-Paakkanen et al., 1980; Forni et al., 1971), although a slight increase was noted in workers exposed to toluene and benzene (Forni et al., 1971; Funes-Craviota et al., 1977). This finding is supported by studies of cultured human lymphocytes exposed to toluene in vitro; no elevation of chromosomal aberrations or sister chromatid exchanges was observed (Gerner-Smidt and Friedrich, 1978).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1987. Drinking Water Criteria Document for Toluene. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Drinking Water, Washington, DC. ECAO-CIN-408.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The values in the 1987 Drinking Water Criteria Document for Toluene have received peer and administrative review.

Agency Work Group Review: 09/15/87

Verification Date: 09/15/87

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm V. Singh / ORD -- (202)260-5958 / FTS 260-5958

Robert E. McGaughy / ORD -- (202)260-5898 / FTS 260-5898

--------------------------- PROTECTION AND FIRST AID -----------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (TOLUENE)
1000 ppm: Any chemical cartridge respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation or damage may require eye protection. / Any supplied-air respirator. * Substance reported to cause eye irritation or damage may require eye protection. / Any powered air-purifying respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection.
2000 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece. / Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap wash promptly
INHALATION: art resp
INGESTION: no vomit

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: remove to fresh air, give artificial respiration and oxygen if needed; call a doctor.

INGESTION: do NOT induce vomiting; call a doctor.
EYES: flush with water for at least 15 min.
SKIN: wipe off, wash with soap and water.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ------------------------

FIRE EXTINGUISHMENT: Carbon dioxide or dry chemical for small fires, ordinary foam for large fires. Note: Water may be ineffective CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Toluene
DOT ID NUMBER: UN1294

ERG93 GUIDE 27

POTENTIAL HAZARDS
*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
Material may be transported hot.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
EMERGENCY ACTION
Keep unnecessary people away; isolate hazard area and deny entry.
Stay upwind; keep out of low areas.
Positive pressure self-contained breathing apparatus (SCBA) and structural fire
*Isolate for 1/2 mile in all directions if tank, rail car or tank truck is invo
CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping
If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk.
Apply cooling water to sides of containers that are exposed to flames until wel
For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if
Withdraw immediately in case of rising sound from venting safety device or any
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.

Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and
rge Spills: Dike far ahead of liquid spill for later disposal.
FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give
In case of contact with material, immediately flush eyes with running water for
Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS --------------------------------

CHEMTOX RECORD 1655   LAST UPDATE OF THIS RECORD: 03/09/95

NAME: DICHLOROMETHANE

SYNONYMS: AEROTHENE MM; CHLORURE DE METHYLENE (French); DCM; DICHLOROMETHANE; DICHLOROMETHANE (DOT); FREON 30; METHANE DICHLORIDE; METHYLENE BICHLORIDE; METHYLENE CHLORIDE; METHYLENE CHLORIDE (DOT); METHYLENE DICHLORIDE; METYLENU CHLOREK (Polish); NARKOTIL; NCI-C50102; SOLAESTHIN; SOLMETHINE; METHANE, DICHLORO-

CAS: 75-09-2   RTECS: PA8050000

FORMULA: CH2Cl2   MOL WT: 84.93

WLN: G1G

CHEMICAL CLASS: ST

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless liquid with a chloroform-like odor [note: a gas above 104 f]

BOILING POINT:	313.15 K	40 C	104 F
MELTING POINT:	176.49 K	-96.7 C	-142 F
FLASH POINT:		Not available	
AUTO IGNITION:	913 K	639.8 C	1183.8 F

VAPOR PRESSURE:	350mm @ 20 C
UEL:	19 %
LEL:	12 %
IONIZATION POTENTIAL (eV):	11.35
VAPOR DENSITY:	2.9 (air=1)
EVAPORATION RATE:	14.50(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	1.33
DENSITY:	1.36174g/mL @ 0 C
WATER SOLUBILITY:	1.3%
INCOMPATIBILITIES:	strong oxidizers, strong caustics, chemically active metals, such as aluminum or magnesium powders; sodium, potassium. reacts violently with lithium, sodium potassium alloy, potassium-tert-butoxide, (potassium hydroxide+n-methyl-n-nitrosourea) ■sax
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	PHOSGENE/CORROSIVE. HIGHLY TOXIC ARID IRRITATING FUMES ■THIC. WHEN HEATED TO

	DECOMPOSE, EMITS HIGHLY TOXIC FUMES OF PHOSGENE ■SAX.
ODOR DETECTED AT (ppm):	214 PPM
ODOR DESCRIPTION:	SWEETISH (LIKE CHLOROFORM OR ETHER) Source:NYDH
100 % ODOR DETECTION:	No data

------------------------------ REGULATIONS ---------------------------------

DOT hazard class:	6.1 POISON
DOT guide:	74
Identification number:	UN1593
DOT shipping name:	Dichloromethane
Packing group:	III
Label(s) required:	KEEP AWAY FROM FOOD
Special provisions:	N36,T13
Packaging exceptions:	173.153
Non bulk packaging:	173.203
Bulk packaging:	173.241
Quantity limitations-	
Passenger air/rail:	60 L
Cargo aircraft only:	220 L
Vessel stowage:	A
Other stowage provisions:	

STCC NUMBER: 4941132

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
  Maximum Contaminant Levels (MCL): 0.005 mg/L (01/17/94)
  Maximum Contaminant Level Goals (MCLG): 0 mg/L (01/17/94)

CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U080
CERCLA REF:	Y
RQ DESIGNATION:	C 1000 pounds (454 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Acute toxicity: Toxic. LD50 > 50 and <= 500 mg/kg (oral rat). Acute toxicity: Irritant Acute toxicity: adverse effect to target organs. Chronic toxicity: carcinogen Chronic toxicity: adverse effect to target organ after long period of exposure. Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin.
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class: ORM-A

Mailability: Domestic service and air transportation shipper's declaration required

Max per parcel: 10 GAL; 1 PT

NFPA CODES:

HEALTH HAZARD (BLUE): (2) Hazardous to health. Area may be entered with self-contained breathing apparatus.

FLAMMABILITY (RED) : (1) This material must be preheated before ignition can occur.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
ATSDR Toxicology Profile available (NTIS** PB/89/194468/AS)
California Assembly Bill 1803 Well Monitoring Chemicals.
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Department of Health Services Drinking Water Action List.
California Assembly Bill 1807 Toxic Air Contaminants.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
DICHLOROMETHANE [75-09-2]
DOT Hazardous Materials Table. 49 CFR 172.101
EPA Carcinogen Assessment Group List
EPA List of VOC chemicals from 40 CFR 60.489
EPA Office of Pesticide Programs. List of active ingredients, 24 April, 1989.
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82
EPA TSCA 8(d) Health and Safety Data Rule - effective date 10/04/82
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
National Toxicology Program list of anticipated human carcinogens
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Suspected carcinogen (ACGIH). "Threshold Limit Values for 1992-1993"
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA ----------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 300-700 ppm for 3-5 hours has caused slight loss of muscle control and coordination. effects of higher concentrations include stupor, dizziness, chest pain, arm and leg pains, loss of feeling, loss of appetite, hot flashes and death. SKIN: may be irritating if confined on the skin by gloves or clothing. may be absorbed slowly through the skin to cause symptoms listed under inhalation. Eyes: may cause pain, irritation and burns. INGESTION: accidental ingestion of paint removers containing methylene chloride as the main ingredient have reportedly caused headache, nausea, vomiting, visual disturbance, presence of blood in the urine, and unconsciousness.(NYDH)

LONG TERM TOXICITY: same symptoms as above. prolonged exposure can cause changes in blood, hallucinations and decreased response to visual and auditory stimulation. some long term exposures have also resulted in damage to the liver. most of the effects will disappear after exposure stops. methylene chloride caused genetic effects in certain bacteria and caused birth defects in chickens. in laboratory studies, methylene chloride has also been shown to cause tumors in mice and rats. whether methylene chloride causes defects or tumors in humans is not known.(NYDH)

TARGET ORGANS: skin, cvs, eyes, CNS

SYMPTOMS: INHALATION: anesthetic effects, nausea and drunkenness. CONTACT WITH SKIN AND EYES: skin irritation, irritation of eyes and nose. Source: CHRIS

CONC IDLH: 2300PPM

NIOSH REL: Potential occupational carcinogen --LOWEST FEASIBLE

ACGIH TLV: TLV = 50ppm Suspected human carcinogen (A2)
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 500 PPM; CEILING = 1000 PPM; MAXIMUM PEAK FOR 5 MINUTES IN ANY 2 HOURS = 2000
Final Rule Limits:
TWA = 500 ppm
CEILING = 1000 PPM; MAXIMUM PEAK ABOVE CEILING FOR 5 MINUTES IN ANY 2 HOURS = 2000 ppm

MAK INFORMATION: 100 ppm

360 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Carcinogen defined by NIOSH with no further categorization.
NTP: Carcinogen defined by NTP as reasonably anticipated to be carcinogenic, with limited evidence in humans or sufficient evidence in experimental animals.
ACGIH: Carcinogen defined by ACGIH TLV Committee as a suspected carcinogen, based on either limited epidemological evidence or demonstration of carcinogenicity in experimental animals.
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-hmn LDLo:357 mg/kg 34ZIAG -,390,69
PERIPHERAL NERVE AND SENSATION
Paresthesia
BEHAVIORAL
Somnolence(general depressed activity)
BEHAVIORAL
Convulsions or effect on seizure threshold

ihl-hmn TCLo:500 ppm/1Y-I ABHYAE 43,1123,68
BEHAVIORAL
Altered sleep time(including change in righting reflex)
BEHAVIORAL
Somnolence(general depressed activity)
CARDIAC
Change in rate

LD50 value: orl-rat LD50:1600 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:1600 mg/kg
ihl-rat LC50:88 gm/m3/30M
ipr-rat LD50:916 mg/kg
ihl-mus LC50:14400 ppm/7H

ipr-mus LD50:437 mg/kg
scu-mus LD50:6460 mg/kg
unr-mus LD50:4770 mg/kg
orl-dog LDLo:3 gm/kg
ihl-dog LCLo:14108 ppm/7H
ipr-dog LDLo:950 mg/kg
ivn-dog LDLo:200 mg/kg
ihl-cat LCLo:43400 mg/m3/4.5H
orl-rbt LDLo:1900 mg/kg
ihl-rbt LCLo:10000 ppm/7H
scu-rbt LDLo:2700 mg/kg
ihl-gpg LCLo:5000 ppm/2H

IRRITATION DATA: (Source: NIOSH RTECS 1992)

skn-rbt 810 mg/24H SEV
eye-rbt 162 mg MOD
eye-rbt 10 mg MLD

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:4500 ppm/24H (1-17D preg) TXAPA9 52,29,80
EFFECTS ON NEWBORN
Behavioral

ihl-rat TCLo:1250 ppm/7H (6-15D preg) TXAPA9 32,84,75
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system

California Prop 65: Carcinogen (04/01/88)
No significant risk level-inhalation 200. ugD (01/01/94)
No significant risk level 50. ugD (01/01/94)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Dichloromethane; CASRN 75-09-2 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Dichloromethane
CASRN -- 75-09-2
Primary Synonym -- Methylene Chloride
Last Revised -- 01/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a

low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification --B2; probable human carcinogen

Basis -- Based on inadequate human data and sufficient evidence of carcinogenicity in animals; increased incidence of hepatocellular neoplasms and alveolar/bronchiolar neoplasms in male and female mice, and increased incidence of benign mammary tumors in both sexes of rats, salivary gland sarcomas in male rats and leukemia in female rats. This classification is supported by some positive genotoxicity data, although results in mammalian systems are generally negative.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. Neither of two studies of chemical factory workers exposed to dichloromethane showed an excess of cancers (Ott et al., 1983; Friedlander et al., 1978; Hearne and Friedlander, 1981). The Ott et al. (1983) study was designed to examine cardiovascular effects, and consequently the study period was too short to allow for latency of site-specific cancers. In the Friedlander et al. (1978) study, exposures were low, but the data provided some suggestion of an increased incidence of pancreatic tumors. This study was recently updated to include a larger cohort, followed through 1984, and an investigation of possible confounding factors (Hearne et al., 1986, 1987). A nonsignificant excess in pancreatic cancer deaths was observed, which was interpreted by EPA (1987a) as neither clear evidence of carcinogenicity in humans, nor evidence of noncarcinogenicity. An update of the Ott et al. (1983) study, based on longer follow-up, indicated possible elevation of liver and biliary tract cancers (TSCA section 8(e) submission no. 8eHQ-0198-0772 FLWP et seq., 1989).

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. Dichloromethane administered in the drinking water induced a significant increase in combined hepatocellular carcinoma and neoplastic nodules in female F344 rats and a nonsignificant increase in combined hepatocellular carcinoma and neoplastic nodules in male B6C3F1 mice (NCA, 1982, 1983). Two inhalation studies with dichloromethane have shown an increased incidence of benign mammary tumors in both sexes of Sprague-Dawley (Burek et al., 1984) and F344 (NTP, 1986) rats. Male Sprague-Dawley rats had increased salivary gland sarcoma (Burek et al., 1984) and female F344 rats had increased leukemia incidence (NTP, 1986). Both sexes of B6C3F1 mice developed liver and lung tumors after dichloromethane treatment (NTP, 1986).

In a 2-year study by the National Coffee Association (1982, 1983), groups of 85 F344 rats/sex/dose received 5, 50, 125, or 250 (mg/kg)/day of dichloromethane in the drinking water. Control groups consisted of 135 rats/sex. In female rats the incidence of combined hepatocellular carcinoma and neoplastic nodules was statistically significantly increased in the 50 and 250 mg/kg dose groups when compared with matched controls (0/134, 1/85, 4/83, 1/85, and 6/85 in the five dose groups 0, 5, 50, 125, and 250 (mg/kg)/day, respectively). The incidence of hepatocellular carcinoma alone was not significantly increased (0/134, 0/85, 2/83, 0/85, 2/85). The combined incidence of hepatocellular carinoma and neoplastic nodules in controls and the 4 dose groups (472 rats: 4 with carcinoma and 8 with neoplastic nodules) was similar to that for historical controls (419 rats; 5 with carcinoma, 19 with neoplastic nodules). Male rats showed no increase in liver tumors.

In the same National Coffee Association study (1982, 1983), B6C3F1 mice received 0, 60, 125, 185, or 250 (mg/kg)/day of dichloromethane in drinking water. Treatment groups consisted of 50 female mice and 200, 100, 100, and 125 male mice (low to high dose). One hundred females and 125 males served as controls. Male mice had an increased incidence of combined neoplastic nodules and hepatocellular carcinoma (24/125, 51/200, 30/100, 31/99, 35/125). The increase was not dose-related, but the pairwise comparisons for the two mid-dose groups were reported to be statistically significant (U.S. EPA, 1985a). The hepatocellular carcinoma incidence alone for male mice (which was about 55 to 65% of the total) was not significantly elevated. Female mice did not have increased liver tumor incidence. The EPA (1985b) regarded this study as suggestive but not conclusive evidence for carcinogenicity of dichloromethane.

A gavage bioassay of dichloromethane conducted by NTP (1982) has not been published because of high mortality, much of which was attributed to gavage accidents.

Inhalation exposure of 107 to 109 Syrian hamsters/sex/dose to 0, 500, 1500, or 3500 ppm of dichloromethane for 6 hours/day, 5 days/week for 2 years did not induce neoplasia (Burek et al., 1984). Sprague-Dawley rats (129/sex/dose) were exposed under the same conditions. Female rats administered the highest dose experienced significantly reduced survival from 18-24 months. Female rats showed a dose-related increase in the average number of benign mammary tumors per rat (1.7, 2.3, 2.6, 3.0), although the numbers of rats with tumors were not significantly increased. A similar response was observed in male rats, but to a lesser degree. In the male rats there was a statistically significant positive trend in the incidence of sarcomas of the salivary gland (1/93, 0/94, 5/91, 11/88); the incidence was significantly elevated at the high dose. There is a question as to whether these doses reached the MTD, particularly in the hamsters and the male rats. In another study (Dow Chemical Co., 1982), 90 Sprague-Dawley rats/sex were exposed by inhalation to 0, 50, 200, or 500 ppm dichloromethane for 20 months (male) or 24 months (female). No salivary tumors were observed, but there was an exposure-related increase in the total number of benign mammary tumors in female rats, although the increase was not statistically significant in any individual exposure group.

Groups of 50 each male and female F344/N rats and B6C3F1 mice were exposed to dichloromethane by inhalation, 6 hours/day, 5 days/week for 2 years (NTP, 1986). Exposure concentrations were 0, 1000, 2000, or 4000 ppm for rats and 0, 2000, or 4000 ppm for mice. Survival of male rats was low; however, this apparently was not treatment-related. Survival was decreased in a treatment-related fashion for male and female mice and female rats. Mammary adenomas and fibroadenomas were significantly increased in male and female rats after survival adjustment, as were mononuclear cell leukemias in female rats. Among treated mice of both sexes there were significantly increased incidences of hepatocellular adenomas and carcinomas, and of alveolarbronchiolar adenomas and carcinomas, by life table tests. Adenomas and carcinomas were significantly increased alone as well as in combination. In addition, there were significant dose-related increases in the number of lung tumors per animal multiplicity in both sexes of mice.

Two inhalation assays using dogs, rabbits, guinea pigs, and rats showed no tumors, but were not conducted for the lifetime of the animals (Heppel et al., 1944; MacEwen et al., 1972). Theiss et al., (1977) injected Strain A male mice intraperitoneally with 0, 160, 400, or 800 mg/kg of dichloromethane 16 to 17 times, over 5 to 6 weeks. Survival of the animals was poor. The animals remaining 24 weeks after the first treatment were killed and examined for lung tumors; pulmonary adenomas were found.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Dichloromethane was mutagenic for Salmonella typhimurium with or without the addition of hepatic enzymes (Green, 1983) and produced mitotic recombination in yeast (Callen et al., 1980). Results in cultured mammalian cells have generally been negative, but dichloromethane has been shown to transform rat embryo cells and to enhance viral transformation of Syrian hamster embryo cells (Price et al., 1978; Hatch et al., 1983). Although chlorinated solvents have often been suspected of acting through a nongenotoxic mechanism of cell proliferation, Lefevre and Ashby (1989) found methylene chloride to be unable to induce hepatocellular division in mice.

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

___II.B.1. SUMMARY OF RISK ESTIMATES

Oral Slope Factor -- 7.5E-3 per (mg/kg)/day

Drinking Water Unit Risk -- 2.1E-7 per (ug/L)

Extrapolation Method -- Linearized multistage procedure, extra risk

Drinking Water Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	5E+2 ug/L
E-5 (1 in 100,000)	5E+1 ug/L
E-6 (1 in 1,000,000)	5E+0 ug/L

___II.B.2. DOSE-RESPONSE DATA (CARCINOGENICITY, ORAL EXPOSURE)

Tumor Type -- hepatocellular adenomas or carcinomas (NTP) and hepatocellular cancer and neoplastic nodules (NCA)
Test Animals -- mouse/B6C3F1 (female, NTP; male, NCA)
Route -- inhalation (NTP); drinking water (NCA)
Reference -- NTP, 1986; National Coffee Association (NCA), 1983

Dose				
Administered		Human Equivalent	Tumor	
(ppm)	mg/kg/day	(mg/kg)/day	Incidence	Reference
0	0	0	3/50	NTP, 1986
2000	1582	122	16/48	
4000	3162	244	40/48	
	0	0	24/125	NCA, 1983
	60	4.5	51/200	
	125	9.4	30/100	
	185	14.0	31/99	
	250	18.9	35/125	

___II.B.3. ADDITIONAL COMMENTS (CARCINOGENICITY, ORAL EXPOSURE)

The slope factor is an arithmetic mean of slope factors derived from NTP(1986) and the National Coffee Association (1983) data, 2.6E-3 per (mg/kg)/day and 1.2E-2 per (mg/kg)/day, respectively. The use of liver tumor data from the NTP inhalation bioassay was considered valid since dichloromethane is rapidly absorbed following either inhalation or ingestion.

Dose conversions used the mean body weight for female mice at the midpoint of the bioassay, and an estimated inhalation rate of 0.0407 cu.m/day. To obtain estimates of unit risk for humans, an inhalation rate of 20 cu.m/day was assumed. Dichloromethane was considered to be well-absorbed as a vapor at low doses. No pharmacokinetic or metabolism data have been used to modify the oral unit risk estimate, because such analyses have not yet been carried out.

The unit risk should not be used if the water concentration exceeds 5E+4 ug/L, since above this concentration the unit risk may not be appropriate.

___II.B.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, ORAL EXPOSURE)

Adequate numbers of animals were used in both assays. Risk estimates were based on the more sensitive sex in each study. The two risk estimates were within a factor of 5.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

___II.C.1. SUMMARY OF RISK ESTIMATES

Inhalation Unit Risk -- 4.7E-7 per (ug/cu.m)

Extrapolation Method -- Linearized multistage procedure, extra risk

Air Concentrations at Specified Risk Levels:

Risk Level	Concentration
E-4 (1 in 10,000)	2E+2 ug/cu.m
E-5 (1 in 100,000)	2E+1 ug/cu.m
E-6 (1 in 1,000,000)	2E+0 ug/cu.m

___II.C.2. DOSE-RESPONSE DATA FOR CARCINOGENICITY, INHALATION EXPOSURE

Tumor Type -- combined adenomas and carcinomas
Test Animals -- mouse/B6C3F1, female
Route -- inhalation
Reference -- NTP, 1986

	Dose			
Tumor Type	Administered (ppm)	Transformed Animal (mg/kg)/day	Human Equivalent (mg/kg)/day	Tumor Incidence
Liver	0	0	0	3/45
	2000	1582	356	16/46
	4000	3162	712	40/46

Lung	0	0	0	3/45
	2000	1582	356	30/46
	4000	3162	712	41/46

___II.C.3. ADDITIONAL COMMENTS (CARCINOGENICITY, INHALATION EXPOSURE)

The unit risk of 4.7E-7 per (ug/cu.m), which incorporates information on pharmacokinetics and metabolism of dichloromethane, is approximately nine-fold lower than the previous applied dose estimate (U.S. EPA, 1987a,b). Internal dose estimates were based on the metabolism of dichloromethane by the glutathione-s-transferase pathway, as estimated by the model developed by Andersen et al. (1987). The internal dose was corrected for interspecies differences in sensitivity by using the surface area correction factor.

Calculation of a slope factor from the unit risk is inappropriate when pharmacokinetic models are used. (When dose-response relationships are figured on the basis of internal or metabolized dose, a slope factor in terms of per (mg/kg)/day represents a back calculation using different absorption assumptions than the pharmacokinetic models. This introduces possible contradictions.)

The unit risk should not be used if the air concentration exceeds 2E+4 ug/cu.m, since above this concentration the unit risk may differ from that stated. Since the unit risk is based on a pharmacokinetic model, the risk may change with alterations in exposure patterns. Thus, the unit risk presented here may not be applicable to acute, high exposures.

___II.C.4. DISCUSSION OF CONFIDENCE (CARCINOGENICITY, INHALATION EXPOSURE)

Adequate numbers of animals were observed and tumor incidences were significantly increased in a dose-dependent fashion. Analysis excluding animals that died before observation of the first tumors produced similar risk estimates, as did time-to-tumor analysis. The use of animal and human metabolism and pharmacokinetic data reduces some of the uncertainty typically associated with dose-risk extrapolation. A great deal of uncertainty still exists, however, in the estimates of internal dose generated by the model of Andersen et al. (1987). Important uncertainties remain regarding the pharmacokinetics, pharmacodynamics, and mechanisms of carcinogenicity for dichloromethane.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985a. Health Assessment Document for Dichloromethane (Methylene Chloride). Final Report. Office of Health and Environmental Assessment, Washington, D.C. EPA/600/8-82/004F.

U.S. EPA. 1985b. Addendum to the Health Assessment Document for Dichloromethane (methylene chloride). Updated carcinogenicity assessment. Prepared by the Carcinogen Assessment Group, OHEA, Washington, DC. EPA/600/8-82/004FF.

U.S. EPA. 1987a. Update to the Health Assessment Document and Addendum for Dichloromethane (Methylene Chloride): Pharmacokinetics, Mechanism of Action and Epidemiology. Review Draft. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8-87/030A.

U.S. EPA. 1987b. Technical Analysis of New Methods and Data Regarding Dichloromethane Hazard Assessments. Review Draft. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8- 87/029A.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The Addendum to the Health Assessment Document, the Update to the Health Assessment Document and Addendum, and the Technical Analysis of New Methods and Data for dichloromethane have received Agency and external review, including a review by the Science Advisory Board (SAB). Although the last two documents are not yet finalized and the SAB comments are not yet incorporated, these do not alter this document's analyses or conclusions.

Agency Work Group Review: 11/12/86, 12/04/86, 04/06/89

Verification Date: 04/06/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Lorenz Rhomberg / ORD -- (202)260-5723 / FTS 260-5723

Dharm V. Singh / ORD -- (202)260-5898 / FTS 260-5898

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister mask, safety glasses, protective clothing.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:

Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes wet.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (DICHLOROMETHANE)
750 ppm: Any supplied-air respirator. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection.
1875 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require eye protection.
3750 ppm: Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
5000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: remove from exposure. Give oxygen if needed.
INGESTION: no specific antidote. CONTACT WITH
SKIN AND
EYES: remove contaminated clothing; wash skin or eyes if affected.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

----------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: USE WATER SPRAY TO KEEP FIRE-EXPOSED CONTAINERS COOL AND TO FLUSH SPILLAGE TO AVOID FURTHER EXPOSURES. Note: CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Dichloromethane
DOT ID NUMBER: UN1593

ERG93 GUIDE 74

POTENTIAL HAZARDS

*HEALTH HAZARDS
Vapors may cause dizziness or suffocation.
Exposure in an enclosed area may be very harmful.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.
Most vapors heavier than air.
*Air/vapor mixtures may explode when ignited.
Container may explode in heat of fire.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind, out of low areas, and ventilate closed spaces before entering. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. Remove and isolate contaminated clothing at the site. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical or CO2.
Large Fires: Water spray, fog or regular foam.
Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site. Use first aid treatment according to the nature of the injury.

CHEMTOX DATA

------------------------------ IDENTIFIERS ------------------------------

CHEMTOX RECORD	444	LAST UPDATE OF THIS RECORD:	03/09/95
NAME:	ETHYL ACETATE		
SYNONYMS:	ACETIC ETHER; ACETIDIN; ACETOXYETHANE; AETHYLACETAT (German); ESSIGESTER (German); ETHYLACETAAT (Dutch); ETHYL ACETATE; ETHYL ACETATE (DOT); ETHYL ACETIC ESTER; ETHYLE (ACETATE D') (French); ETHYL ETHANOATE; ETILE (ACETATO DI) (Italian); OCTAN ETYLU (Polish); VINEGAR NAPHTHA; ACETIC ACID, ETHYL ESTER; ACETIC ACID ETHYL ESTER		
CAS:	141-78-6	RTECS:	AH5425000
FORMULA:	C4H8O2	MOL WT:	88.12
WLN:	2OV1		
CHEMICAL CLASS:	Ester		

See other identifiers listed below under Regulations.

------------------------------ PROPERTIES ------------------------------

PHYSICAL DESCRIPTION: colorless liquid with a pleasant fruity odor

BOILING POINT:	350.38 K	77.2 C	171 F
MELTING POINT:	189.15 K	-84 C	-119.2 F
FLASH POINT:	268 K	-5.15 C	22.7 F
AUTO IGNITION:	699 K	425.8 C	798.6 F
CRITICAL TEMP:	523 K	249.85 C	481.73 F
CRITICAL PRESS:	3.8 kN/M2	37.4 atm	550 psia
HEAT OF VAP:	158 Btu/lb	87.74 cal/g	3.671x E5 J/kg
HEAT OF COMB:	-10110 Btu/lb	-5620 cal/g	-235x E5 J/kg

VAPOR PRESSURE:	73mm @ 20 C
UEL:	11 %
LEL:	2.2 %
IONIZATION POTENTIAL (eV):	10.01
VAPOR DENSITY:	3.0 (air=1)
EVAPORATION RATE:	4.94(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.902 20C
DENSITY:	0.902 g/mL @ 20 C
WATER SOLUBILITY:	8.7%
INCOMPATIBILITIES:	nitrates, strong oxidizers, strong alkalies, strong acids
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	CHLOROSULFONIC ACID, OLEUM, K-TERT-BUTOXIDE Source: SAX
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors

ODOR DETECTED AT (ppm):	1 ppm
ODOR DESCRIPTION:	Pleasant, fruity Source:CHRIS
100 % ODOR DETECTION:	No data

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1173
DOT shipping name:	Ethyl acetate
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T2
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER:	4909160

CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	U112,D001
CERCLA REF:	Y
RQ DESIGNATION:	D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Acute toxicity: Irritant Acute toxicity: adverse effect to target organs. Chronic toxicity: adverse effect to target organ after long period of exposure. Chronic toxicity: mutagen. Fire hazard: flammable.

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - September 1989
ETHYL ACETATE [141-78-6]
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Third Third Wastes List. 40 CFR 268.12. 54 FR 26594 (June 23, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: IRRITATION TO EYES, NOSE AND THROAT. SEVERE
OVEREXPOSURE: WEAKNESS, DROWSINESS, UNCONCIOUSNESS. **
Source: 1

LONG TERM TOXICITY: irritation to skin. ** source: 1

TARGET ORGANS: eyes, gums, respiratory passages, skin, liver, kidneys

SYMPTOMS: Headache, irritation of respiratory passages and eyes,
dizziness and nausea, weakness, loss of consciousness.
Source: CHRIS

CONC IDLH: 2000PPM

NIOSH REL:

ACGIH TLV: TLV = 400ppm(1,440 mg/M3)
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 400 ppm(1400mg/M3)
Final Rule Limits:
TWA = 400 ppm (1400 mg/M3)

MAK INFORMATION: 400 ppm
1400 mG/M3
Local irritant: Peak = 2xMAK for 5 minutes, 8 times per shift.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-hmn TCLo:400 ppm JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

LD50 value: orl-rat LD50:5620 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5620 mg/kg
scu-rat LDLo:5 gm/kg
orl-mus LD50:4100 mg/kg
ihl-mus LC50:45 gm/m3/2H
ipr-mus LD50:709 mg/kg
ihl-cat LCLo:61 gm/m3
scu-cat LD50:3 gm/kg
orl-rbt LD50:4935 mg/kg
skn-rbt LD50:>20 gm/kg
orl-gpg LD50:5500 mg/kg
scu-gpg LD50:3 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 400 ppm

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister or air mask; goggles or face shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (ETHYL ACETATE)
1000 ppm: Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s). / Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed.
10000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome, move him to fresh air immediately and call a physician; if breathing is irregular or stopped, start resuscitation and administer oxygen.
EYES: flush with water for at least 15 min.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not

breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, carbon dioxide or dry chemicals.
CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Ethyl acetate
DOT ID NUMBER: UN1173

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POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.

Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 3539 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	ISOPROPYL ALCOHOL
SYNONYMS:	ALCOOL ISOPROPILICO (Italian); ALCOOL ISOPROPYLIQUE (French); AVANTINE; DIMETHYLCARBINOL; ISOHOL; ISOPROPANOL; ISO-PROPYLALKOHOL (German); LUTOSOL; PETROHOL; PROPROPAN-2-OL; 2-PROPANOL; i-PROPANOL (German); sec-PROPYL ALCOHOL; i-PROPYLALKOHOL; IPA; PROPAN-2-OL; SEC-PROPYL ALCOHOL; ARQUAD DMCB, COMPONENT OF (WITH 169153); VISCO 1152, COMPONENT OF (WITH 107601); PRO
CAS:	67-63-0 RTECS: NT8050000
FORMULA:	C3H80 MOL WT: 60.11
WLN:	QY1
CHEMICAL CLASS:	Alcohol

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless liquid with the odor of rubbing alcohol

BOILING POINT:	355.65 K	82.5 C	180.5 F
MELTING POINT:	184.27 K	-88.9 C	-128 F
FLASH POINT:	284.82 K	11.67 C	53 F
AUTO IGNITION:	672.15 K	399 C	750.2 F

VAPOR PRESSURE:	33 mm @ 20 C
UEL:	12.7 %
LEL:	2.3 %
IONIZATION POTENTIAL (eV):	10.15
VAPOR DENSITY:	2.07 (air=1)
EVAPORATION RATE:	1.70(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.785 20C
DENSITY:	0.785
WATER SOLUBILITY:	MISCIBLE
INCOMPATIBILITIES:	keep away from heat and open flame; reacts vigorously with oxidizing materials
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	REACTS VIOLENTLY WITH NITROFORM, OLEUM, PHOSGENE, POTASSIUM, TERT-BUTOXIDE, ALUMINUM, AL TRIISOPROPOXIDE, CROTONALDEHYDE, OXIDANTS Source: SAX
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	NA
ODOR DETECTED AT (ppm):	90 mg/m#L3

ODOR DESCRIPTION: nonresidual Source:CHRIS
100 % ODOR DETECTION: No data

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1219
DOT shipping name:	Isopropanol [or] isopropyl alcohol
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T1
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER: 4909205

CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	Not listed
EPA WASTE NUMBER:	D001
CERCLA REF:	N
RQ DESIGNATION:	Not listed
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Acute toxicity: Irritant Acute toxicity: adverse effect to target organs. Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin. Fire hazard: flammable. Chronic toxicity: carcinogen
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act Section 112 Hazardous Air Pollutants List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 02/12/87
EPA TSCA 8(d) Health and Safety Data Rule - effective date 12/15/86
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Section 12(b) Export Rule Notification.
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
ISOPROPYL ALCOHOL [67-63-0]
Massachusetts Substance List.
National Toxicology Program (NTP) list of human carcinogens
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
RCRA Hazardous Waste
SARA Section 313 Toxic Chemicals List
TSCA Chemical Hazard Information Profile (CHIP) available - dated 11/20/79
TSCA Chemical Hazard Information Profile (CHIP) available - dated 12/29/77

---------------------------- TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: INHALATION: irritation of the nose and throat may occur at 400 ppm and above. SKIN: 5% solution may cause irritation and dryness. Eyes: vapor levels of 20 ppm or above may result in irritation. liquid may cause corneal burns and eye damage. INGESTION: 22.5 ml (2/3 oz.) has caused salivation, reddening of face, stomach pain, depression, dizziness, headache, vomiting and unconsciousness. ingestion of 100 ml (3 oz.) has caused death.(NYDH)

LONG TERM TOXICITY: no reported long term exposure effects.(NYDH)

TARGET ORGANS: eyes,skin,resp sys

SYMPTOMS: Vapors cause mild irritation of eyes and upper respiratory tract; high concentrations may be anesthetic. Liquid irritates eyes and may cause injury; harmless to skin; if ingested causes drunkenness and vomiting. Source: CHRIS

CONC IDLH:	2000ppm
NIOSH REL:	400 ppm Time weighted averages for 8-hour exposure 984 mg/M3 Time weighted averages for 8-hour exposure 800 ppm Ceiling exposures which shall at no time be exceeded 1968 mg/M3 Ceiling exposures which shall at no time be exceeded
ACGIH TLV:	TLV = 400ppm(983 mg/M3)
ACGIH STEL:	STEL = 500 ppm(1,230 mg/M3)
OSHA PEL:	Transitional Limits: PEL = 400 ppm(980mg/M3) Final Rule Limits: TWA = 400 ppm (980 mg/M3) STEL = 500 ppm(1225 mg/M3)
MAK INFORMATION:	400 ppm 980 mG/M3 Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.
CARCINOGEN?:	N STATUS: See below

REFERENCES:

HUMAN SUSPECTED IARC** 15,223,77
ANIMAL INDEFINITE IARC** 15,223,77

CARCINOGEN LISTS:

IARC: Not classified as to human carcinogenicity or probably not carcinogenic to humans.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

orl-man TDLo:14432 mg/kg NEJMAG 277,699,67
- BEHAVIORAL
  - Coma
- VASCULAR
  - BP lowering not characterized in autonomic section
- LUNGS, THORAX, OR RESPIRATION
  - Dyspnea

orl-hmn TDLo:223 mg/kg JLCMAK 12,326,27
- BEHAVIORAL
  - Hallucinations, distorted perceptions

CARDIAC
Pulse rate decreased with fall in BP
VASCULAR
BP lowering not characterized in autonomic section

orl-man LDLo:5272 mg/kg AJCPAI 38,144,62
BEHAVIORAL
Coma
VASCULAR
BP lowering not characterized in autonomic section
LUNGS, THORAX, OR RESPIRATION
Chronic pulmonary edema or congestion

orl-hmn LDLo:3570 mg/kg 34ZIAG -,339,69
BEHAVIORAL
Coma
LUNGS, THORAX, OR RESPIRATION
Respiratory depression
GASTROINTESTINAL
Nausea or vomiting

LD50 value: orl-rat LD50:5045 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5045 mg/kg
ihl-rat LCLo:16000 ppm/4H
ipr-rat LD50:2735 mg/kg
ivn-rat LD50:1088 mg/kg
orl-mus LD50:3600 mg/kg
ihl-mus LCLo:12800 ppm/3H
ipr-mus LD50:4477 mg/kg
scu-mus LDLo:6 gm/kg
ivn-mus LD50:1509 mg/kg
orl-dog LDLo:1537 mg/kg
ivn-dog LDLo:1024 mg/kg
ivn-cat LDLo:1963 mg/kg
orl-rbt LD50:6410 mg/kg
skn-rbt LD50:12800 mg/kg
ipr-rbt LD50:667 mg/kg
ivn-rbt LD50:1184 mg/kg
ipr-gpg LD50:2560 mg/kg
ipr-ham LD50:3444 mg/kg
par-frg LDLo:20 gm/kg
scu-mam LDLo:6 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

orl-rat TDLo:11340 mg/kg (45D pre) GISAAA 43(1),8,78
MATERNAL EFFECTS
Menstrual cycle changes or disorders

orl-rat TDLo:5040 mg/kg (1-20D preg) GISAAA 43(1),8,78
EFFECTS ON FERTILITY
Litter size(# fetuses per litter;measured before birth)

orl-rat TDLo:20160 mg/kg (1-20D preg) GISAAA 43(1),8,78
EFFECTS ON FERTILITY
Pre-implantation mortility

orl-rat TDLo:32400 ug/kg (26W pre) GISAAA 43(1),8,78
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-rat TDLo:6480 mg/kg (26W male/26W pre) GISAAA 43(1),8,78
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

ihl-rat TCLo:3500 ppm/7H (1-19D preg) FCTOD7 26,247,88
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)

ihl-rat TCLo:10000 ppm/7H (1-19D preg) FCTOD7 26,247,88
EFFECTS ON FERTILITY
Pre-implantation mortility
EFFECTS ON FERTILITY
Post-implantation mortality
EFFECTS ON EMBRYO OR FETUS
Fetal death

California Prop 65: Not listed

---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister or air-supplied mask; chemical goggles or face splash shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (ISOPROPYL ALCOHOL)
1000 ppm: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
10000 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed.
20000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome by vapors, remove from exposure immediately; call a physician; if breathing is irregular or has stopped, start resuscitation and administer oxygen.
EYES: flush with water for at least 15 min.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, or carbon dioxide.
Note: Water may be ineffective CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Isopropanol [or] isopropyl alcohol
DOT ID NUMBER: UN1219

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POTENTIAL HAZARDS

*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.

*HEALTH HAZARDS

May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 511 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: 2-BUTANONE

SYNONYMS: ACETONE, METHYL-; AETHYLMETHYLKETON (German); BUTANONE; BUTANONE 2 (French); ETHYL METHYL CETONE (French); ETHYLMETHYLKETON (Dutch); ETHYL METHYL KETONE; ETHYL METHYL KETONE (DOT); KETONE, ETHYL METHYL; MEETCO; METHYL ACETONE; METHYL ACETONE (DOT); METHYL ETHYL KETONE; METHYL ETHYL KETONE (DOT); METILETILCHETONE (Italian); METYLOETYLOKETON (Polish); 2-BUTANONE; MEK; BUTAN-2-ONE; KETONE, METHYL ETHYL; 2-OXOBUTANE; METHYL ETHYL KETONE (MEK)

CAS: 78-93-3 RTECS: EL6475000

FORMULA: C4H8O MOL WT: 72.12

WLN: 2V1

CHEMICAL CLASS: Ketone

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: clear colorless liquid with a fragrant, mint-like, moderately sharp odor

BOILING POINT:	352.72 K	79.5 C	175.2 F
MELTING POINT:	187.04 K	-86.2 C	-123 F
FLASH POINT:	264.4 K	-8.75 C	16.2 F
AUTO IGNITION:	788.7 K	515.5 C	960 F
CRITICAL TEMP:	535.7 K	262.55 C	504.59 F
CRITICAL PRESS:	4.15 kN/M2	40.9 atm	601 psia
HEAT OF VAP:	191 Btu/lb	106.07 cal/g	4.438x E5 J/kg
HEAT OF COMB:	-13480 Btu/lb	-7494 cal/g	-313x E5 J/kg

VAPOR PRESSURE:	78 mm Hg @ 20 C
UEL:	11.5 %
LEL:	1.8 %
IONIZATION POTENTIAL (eV):	9.54
VAPOR DENSITY:	2.42 (air=1)
EVAPORATION RATE:	7.12
SPECIFIC GRAVITY:	0.806 @ 20 C
DENSITY:	0.805 g/mL @ 20 C
WATER SOLUBILITY:	27%
INCOMPATIBILITIES:	very strong oxidizers, chlorosulfonic acid, oleum, potassium-tert-butoxide, heat or flame, chloroform, hydrogen peroxide, nitric acid

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	NO REACTION Source: SAX
STABILITY DURING TRANSPORT:	No Data

NEUTRALIZING AGENTS:	NOT PERTINENT Source: SAX
POLYMERIZATION POSSIBILITIES:	NOT PERTINENT Source: SAX
TOXIC FIRE GASES:	UNBURNED VAPORS
ODOR DETECTED AT (ppm):	10 ppm
ODOR DESCRIPTION:	Like acetone; pleasant; pungent Source:CHRIS
100 % ODOR DETECTION:	6.0 ppm

------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1193
DOT shipping name:	Ethyl methyl ketone [or] methyl ethyl ketone
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T8
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	
STCC NUMBER:	4909243
CLEAN WATER ACT Sect.307:	No
CLEAN WATER ACT Sect.311:	No
CLEAN AIR ACT:	CAA '90 Listed
EPA WASTE NUMBER:	U159,D035,D001
CERCLA REF:	Y
RQ DESIGNATION:	D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	
	Acute toxicity: Irritant
	Acute toxicity: adverse effect to target organs.
	Chronic toxicity: mutagen.
	Chronic toxicity: reproductive toxin.
	Fire hazard: flammable.
LISTED IN SARA Sect 313:	Yes
de minimus CONCENTRATION:	1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:

Hazard class:	Flammable liquid - Mailable as ORM-D
Mailability:	Domestic surface mail only
Max per parcel:	1 QT METAL; 1 PT OTHER

NFPA CODES:

HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.

FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.

REACTIVITY (YELLOW): (0) Stable even under fire conditions.

SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

2-BUTANONE [78-93-3]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
California Assembly Bill 1803 Well Monitoring Chemicals.
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
Clean Air Act of November 15, 1990. List of pollutants.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA 8(a) Preliminary Assessment Information Rule - effective 11/19/82
EPA TSCA 8(d) Health and Safety Data Rule - effective date 10/04/82
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
First Third Wastes List. 40 CFR 268.10. 54 FR 26594 (June 23, 1989)
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 110 Priority List of CERCLA Hazardous Substances
SARA Section 313 Toxic Chemicals List
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

------------------------------ TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: INHALATION: human exposures to levels of 350 ppm caused irritation of the nose and throat. numbness in fingers, arms and legs accompanied by headache, nausea, vomiting and fainting have occurred after exposure to levels of 300-600 ppm. SKIN: contact with liquid or vapor at levels of 300-600 ppm caused severe irritation. liquid is absorbed readily and may cause numbing of fingers and arms. Eyes: exposure to levels of 200 ppm produced irritation. INGESTION: can cause irritation of the mouth, throat and stomach, the severity of which will be dependent upon amount swallowed. symptoms of poisoning include nausea, vomiting, stomach pain and diarrhea. death can occur from ingestion of as little as 1 ounce.(NYDH)

LONG TERM TOXICITY: has been implicated in certain nervous disorders characterized by weakness, fatigue, heaviness in chest and numbness of hands and feet. these symptoms may develop after 1 year of exposure to vapor concentrations of 50-200 ppm. improvement is gradual and may take years after exposure is discontinued.(NYDH)

TARGET ORGANS: CNS, lungs. peripheral nervous system. eye irritation at 350 ppm.

SYMPTOMS: Liquid causes eye burn. Vapor irritates eyes, nose, and throat; can cause headache, dizziness, nausea, weakness, and loss of consciousness. Source: CHRIS

CONC IDLH: 3000ppm

NIOSH REL: 200 ppm Time weighted averages for 8-hour exposure
590 mg/M3 Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 200ppm(590 mg/M3)
ACGIH STEL: STEL = 300 ppm

OSHA PEL: Transitional Limits:
PEL = 200 ppm(590mg/M3)
Final Rule Limits:
TWA = 200 ppm (590 mg/M3)
STEL = 300 ppm(885 mg/M3)

MAK INFORMATION: 200 ppm
590 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 2xMAK for 30 minutes, 4 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)

ihl-hmn TCLo:100 ppm/5M JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

LD50 value: orl-rat LD50:2737 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:2737 mg/kg
ihl-rat LC50:23500 mg/m3/8H
ipr-rat LD50:607 mg/kg
orl-mus LD50:4050 mg/kg
ihl-mus LC50:40 gm/m3/2H
ipr-mus LD50:616 mg/kg
skn-rbt LD50:6480 mg/kg
ipr-gpg LDLo:2 gm/kg
ihl-mam LC50:38 gm/m3

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 350 ppm
skn-rbt 500 mg/24H MOD
skn-rbt 402 mg/24H MLD
skn-rbt 13780 ug/24H open MLD
eye-rbt 80 mg

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
ihl-rat TCLo:3000 ppm/7H (6-15D preg) TXAPA9 28,452,74
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Craniofacial(including nose and tongue)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Urogenital system
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Homeostatis

ihl-rat TCLo:1000 ppm/7H (6-15D preg) TXAPA9 28,452,74
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Musculoskeletal system

California Prop 65: Not listed

------------------------------ EPA's IRIS DATA SUMMARY -------------------------
Methyl ethyl ketone (MEK); CASRN 78-93-3 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Methyl ethyl ketone (MEK)
CASRN -- 78-93-3
Last Revised -- 12/01/89

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on no human carcinogenicity data and inadequate animal data.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Inadequate. No data were available to assess the carcinogenic potential of methyl ethyl ketone by the oral or inhalation routes. In a skin carcinogenesis study, two groups of 10 male C3H/He mice received dermal applications of 50 mg of a solution containing 25 or 29% methyl ethyl ketone in 70% dodecylbenzene twice a week for 1 year. No skin tumors developed in the group of mice treated with 25% methyl ethyl ketone. After 27 weeks, a single skin tumor developed in 1 of 10 mice receiving 29% methyl ethyl ketone (Horton et al., 1965).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Methyl ethyl ketone was not mutagenic for Salmonella typhimurium strains TA98, TA100, TA1535, or TA1537 with or without rat hepatic homogenates (Florin et al., 1980; Douglas et al., 1980). Methyl ethyl ketone induced aneuploidy in the diploid D61, M strain of Saccharomyces cerevisiae (Zimmermann et al., 1985). Low levels of methyl ethyl ketone combined with low levels of nocodazole (another inducer of aneuploidy), also produced significantly elevated levels of aneuploidy in the system (Mayer and Goin, 1987).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1985. Health and Environmental Effects Profile for Methyl Ethyl Ketone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA. 1988. Updated Health Effects Assessment for Methyl Ethyl Ketone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 Updated Health Effects Assessment for Methyl Ethyl Ketone has received Agency review.

Agency Work Group Review: 05/30/89

Verification Date: 05/30/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Dharm V. Singh / ORD -- (202)260-5958 / FTS 260-5958

--------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic canister or air pack; plastic gloves; goggles or face shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (2-BUTANONE)
1000 ppm: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
3000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: remove victim to fresh air; if breathing is irregular or has stopped, start resuscitation and administer oxygen.
EYES: wash with plenty of water for at least 15 min. and call physician.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, or carbon dioxide.
Note: Water may be ineffective CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Ethyl methyl ketone [or] methyl ethyl ketone
DOT ID NUMBER: UN1193

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it

without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 445 LAST UPDATE OF THIS RECORD: 03/09/95

NAME: ACETONE

SYNONYMS: ACETON (German, Dutch, Polish); ACETONE ; DIMETHYLFORMEHYDE; DIMETHYLKETAL; DIMETHYL KETONE; KETONE, DIMETHYL; KETONE PROPANE; beta-KETOPROPANE; METHYL KETONE; PROPANONE; 2-PROPANONE; PYROACETIC ACID; PYROACETIC ETHER; DIMETHYLFORMALDEHYDE

CAS: 67-64-1 RTECS: AL3150000

FORMULA: C3H6O MOL WT: 58.08

WLN: 1V1

CHEMICAL CLASS: Ketone

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless liquid with a fragrant, mint-like odor

BOILING POINT:	329.27 K	56.1 C	133 F
MELTING POINT:	178.9 K	-94.3 C	-137.7 F
FLASH POINT:	255.32 K	-17.83 C	-.1 F
AUTO IGNITION:	738 K	464.8 C	868.8 F
CRITICAL TEMP:	508 K	234.85 C	454.73 F
CRITICAL PRESS:	4.70 kN/M2	46.3 atm	680 psia
HEAT OF VAP:	220 Btu/lb	122.18 cal/g	5.112x E5 J/kg
HEAT OF COMB:	-12250 Btu/lb	-6810 cal/g	-285x E5 J/kg

VAPOR PRESSURE:	196 mm @ 21 C
UEL:	12.8 %
LEL:	2.6 %
IONIZATION POTENTIAL (eV):	6.87 TO 7.19
VAPOR DENSITY:	2 (air=1)
EVAPORATION RATE:	6.06(n-BUTYL ACETATE=1)
SPECIFIC GRAVITY:	0.791 @ 20 C
DENSITY:	0.791
WATER SOLUBILITY:	MISCIBLE
INCOMPATIBILITIES:	ox, acids

REACTIVITY WITH WATER:	No reaction
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data

TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	100 ppm
ODOR DESCRIPTION:	residual; ketonic, pleasant, non-residual Source:CHRIS

100 % ODOR DETECTION: 300 ppm

------------------------------- REGULATIONS ----------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1090
DOT shipping name:	Acetone
Packing group:	II
Label(s) required:	FLAMMABLE LIQUID
Special provisions:	T8
Packaging exceptions:	173.150
Non bulk packaging:	173.202
Bulk packaging:	173.242
Quantity limitations-	
Passenger air/rail:	5 L
Cargo aircraft only:	60 L
Vessel stowage:	B
Other stowage provisions:	

STCC NUMBER: 4908105

CLEAN WATER ACT Sect.307:No
CLEAN WATER ACT Sect.311:No
CLEAN AIR ACT: Not listed
EPA WASTE NUMBER: U002,D001
CERCLA REF: Y
RQ DESIGNATION: D 5000 pounds (2270 kg) CERCLA
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Chronic toxicity: mutagen.
Chronic toxicity: reproductive toxin.
Fire hazard: flammable.
LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 1.0 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Not given
Mailability: Nonmailable
Max per parcel: 0

NFPA CODES:
HEALTH HAZARD (BLUE): (1) Slightly hazardous to health. As a precaution wear self-contained breathing apparatus.
FLAMMABILITY (RED) : (3) This material can be ignited under almost all temperature conditions.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACETONE [67-64-1]
ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 111 List.
DOT Hazardous Materials Table. 49 CFR 172.101
EPA List of VOC chemicals from 40 CFR 60.489
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992
Pennsylvania Hazardous Substance List
RCRA Hazardous Constituents for Ground Water Monitoring. Ap'dx IX to 40 CFR 264
RCRA Hazardous Waste
SARA Section 313 Toxic Chemicals List
Second Third Wastes List. 40 CFR 268.11. 54 FR 26594 (June 23, 1989)
Superfund/CERCLA RQ list. Table 302.4 in 54 FR 50968 (December 11, 1989)
Washington State Discarded Chemical Products List, November 17, 1989

----------------------------- TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: INHALATION: levels of 300 ppm have caused irritation of eyes, nose and throat. levels of 500 to 1,000 ppm for 6 hours have caused, in addition, general weakness and heaviness of the eyelids. exposures of 12,000 ppm for a few minutes may cause weakness in arms and legs and fainting. 20,000 ppm may be fatal on brief exposure. SKIN: liquid acetone may cause drying of the skin, irritation, redness, and an increased chance of infection. Eyes: irritation has been reported at 500 ppm after 3-6 hours. splashes into the eye may result in swelling, irritation, damage to the cornea and blindness. INGESTION: 20 ml (2/3 fluid ounce) may result in excess salivation, nausea, vomiting, stomach pain and possible liver and kidney damage. 200 ml (7 fluid ounces) has resulted in these symptoms and, additionally, swelling of the throat, sores in the mouth and throat, shallow breathing and coma. although 200 ml has been survived with prompt medical attention, death may occur from as little at 100 ml (three and one half fluid ounces).(NYDH)

LONG TERM TOXICITY: levels of 500 to 1,000 ppm can produce eye irritation

after 3 hours. daily exposures at this level have resulted in irritation of throat and lungs, dizziness, and inflammation of stomach and intestines.(NYDH)

TARGET ORGANS: respiratory system, skin, eyes, CNS

SYMPTOMS: INHALATION: vapor irritating to eyes and mucous membranes; acts as an anesthetic in very high concentrations. INGESTION: low order of toxicity but very irritating to mucous membranes. SKIN: prolonged excessive contact causes defatting of the skin, possibly leading to dermatitis. Source: CHRIS

CONC IDLH: 2500PPM

NIOSH REL: 250 ppm Time weighted averages for 8-hour exposure
590 mg/M3 Time weighted averages for 8-hour exposure

ACGIH TLV: TLV = 750ppm(1780 mg/M3)
ACGIH STEL: STEL = 1000 ppm(2380 mg/M3)

OSHA PEL: Transitional Limits:
PEL = 1000 ppm(2400mg/M3)
Final Rule Limits:
TWA = 750 ppm (1800 mg/M3)
STEL = 1000 ppm(2400 mg/M3)
STEL DOES NOT APPLY TO THE CELLULOSE ACETATE FIBER INDUSTRY.

MAK INFORMATION: 500 ppm
1200 mG/M3
Substance with systemic effects, onset of effect less than or equal to 2 hrs: Peak = 5xMAK for 30 minutes, 2 times per shift of 8 hours.

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
orl-man TDLo:2857 mg/kg 34ZIAG -,64,69
BEHAVIORAL
Coma
KIDNEY,URETER,BLADDER
Other changes

orl-man TDLo:2857 mg/kg DIAEAZ 15,810,66
BEHAVIORAL

Coma
BIOCHEMICAL
Metabolism
Other

ihl-man TCLo:440 ug/m3/6M GISAAA 42(8),42,77
BRAIN AND COVERINGS
Recordings from specific areas of CNS

ihl-man TCLo:10 mg/m3/6H GISAAA 42(8),42,77
BIOCHEMICAL
Metabolism
Other carbohydrates

ihl-hmn TCLo:500 ppm JIHTAB 25,282,43
SENSE ORGANS
Nose
Other
SENSE ORGANS
Eye
Conjunctive irritation
LUNGS, THORAX, OR RESPIRATION
Other changes

ihl-man TCLo:12000 ppm/4H AOHYA3 16,73,73
GASTROINTESTINAL
Nausea or vomiting
BEHAVIORAL
Muscle weakness

LD50 value: orl-rat LD50:5800 mg/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:5800 mg/kg
ihl-rat LC50:50100 mg/m3/8H
ipr-rat LDLo:500 mg/kg
ivn-rat LD50:5500 mg/kg
orl-mus LD50:3 gm/kg
ihl-mus LCLo:110 gm/m3/1H
ipr-mus LD50:1297 mg/kg
ivn-mus LDLo:4 gm/kg
orl-dog LDLo:8 gm/kg
ipr-dog LDLo:8 gm/kg
scu-dog LDLo:5 gm/kg
orl-rbt LD50:5340 mg/kg
skn-rbt LD50:20 gm/kg
ivn-rbt LDLo:1576 mg/kg
skn-gpg LD50:>9400 mg/kg
scu-gpg LDLo:5 gm/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

eye-hmn 500 ppm
skn-rbt 395 mg open MLD
eye-rbt 3950 ug SEV

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:273 gm/kg (13W male) NTIS** PB91-185975
PATERNAL EFFECTS
Spermatogenisis

California Prop 65: Not listed

---------------------------- EPA's IRIS DATA SUMMARY -------------------------
Acetone; CASRN 67-64-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Acetone
CASRN -- 67-64-1
Last Revised -- 12/01/90

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2 (Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- D; not classifiable as to human carcinogenicity

Basis -- Based on lack of data concerning carcinogenicity in humans or animals.

___II.A.2. HUMAN CARCINOGENICITY DATA

None.

___II.A.3. ANIMAL CARCINOGENICITY DATA

None.

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Acetone did not show mutagenic activity when tested in Salmonella typhimurium strains TA98 and TA100 or in Schizosaccharomyces pombe strain P1 either in the presence or absence of liver homogenates (McCann et al., 1975; Abbondandolo et al., 1980; Maron et al., 1981; Hallstrom et al., 1981) or in cell transformation systems (Freeman et al., 1973; Rhim et al., 1974; Quarles et al., 1979a,b). Furthermore, acetone gave negative results in assays for chromosomal aberrations and sister chromatid exchange (Norppa et al., 1981; Norppa, 1981; Tates and Kriek, 1981), DNA binding (Kubinski et al., 1981), point mutation in mouse lymphoma cells (Amacher et al., 1980), and transfection of E. coli CR63 cells (Vasavada and Padayatty, 1981). In one study, however, acetone was reported to produce chromosomal aberrations but not sister chromatid exchanges (Kawachi et al., 1980).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

None.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

None.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1988. Updated Health Effects Assessment for Acetone. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and

Assessment Office, Cincinnati, OH for the Office of Solid Waste and Emergency Response, Washington, DC.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The 1988 updated Health Effects Document for Acetone has received Agency review and is approved for publication.

Agency Work Group Review: 12/06/89

Verification Date: 12/06/89

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

Charles Ris / ORD -- (202)260-5895 / FTS 260-5898

---------------------------- PROTECTION AND FIRST AID -------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
organic vapor canister or air-supplied mask; synthetic rubber gloves; chemical safety goggles or face splash shield.

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Immediately remove any clothing that becomes wet to avoid any flammability hazard.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (ACETONE)
1000 ppm: Any chemical cartridge respirator with organic vapor cartridge(s). / Any powered air-purifying respirator with organic vapor cartridge(s). / Any supplied-air respirator. / Any self-contained breathing apparatus.
6250 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require

eye protection.
12500 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any supplied-air respirator with a full facepiece. / Any self-contained breathing apparatus with a full facepiece.
20000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: flush with water immediately for at least 15 min. consult a physician.
SKIN: wash well with water.
INHALATION: if victim overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: seek immediate medical attention

FIRST AID SOURCE: CHRIS Manual 1991
INHALATION: if victim is overcome, remove to fresh air and call a physician; administer artificial respiration if breathing is irregular or stopped.
INGESTION: if victim has swallowed large amounts and is conscious and not having convulsions, induce vomiting and get medical help promptly; no specific antidote known.
SKIN: wash well with water.
EYES: flush with water immediately for at least 15 min. Consult a physician.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

FIRE EXTINGUISHMENT: Alcohol foam, dry chemical, carbon dioxide. Note: Water in straight hose stream will scatter and spread fire and should not be used. CHRIS91

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Acetone

DOT ID NUMBER: UN1090

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION

Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.

*HEALTH HAZARDS

May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.

*SPILL OR LEAK

Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

IDENTIFIERS

CHEMTOX RECORD 247 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	LEAD		
SYNONYMS:	C.I. PIGMENT METAL 4; C.I. 77575; KS-4; LEAD FLAKE; LEAD S2; OLOW (Polish); SI; SO		
CAS:	7439-92-1	RTECS:	OF7525000
FORMULA:	Pb	MOL WT:	207.19
WLN:	PB		
CHEMICAL CLASS:	Metal		

See other identifiers listed below under Regulations.

PROPERTIES

PHYSICAL DESCRIPTION: bluish-grey, soft metal; heavy ductile, soft, gray solid

BOILING POINT:	2013 K	1739.8 C	3163.7 F
MELTING POINT:	600.6 K	327.4 C	621.4 F
FLASH POINT:	Not available		
AUTO IGNITION:	Not available		
VAPOR PRESSURE:	1mm @ 973 C		
UEL:	~		
LEL:	~		
VAPOR DENSITY:	No data		
SPECIFIC GRAVITY:	11.34		
DENSITY:	11.34 g/mL @ 20 C		
WATER SOLUBILITY:	INSOLUBLE; DISSOLVES SLOWLY IN WATER CONTAINING A WEAK ACID		
INCOMPATIBILITIES:	strong ox, hydrogen peroxide, active metals, sodium, potassium, chlorine trifluoride, hydrogen peroxide, zirconium, disdium acetylide, oxidants		

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	RELATIVELY IMPENETRABLE TO RADIATION
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	WHEN HEATED EMITS HIGHLY TOXIC FUMES; CAN REACT VIGOROUSLY WITH OXIDIZING MATERIALS
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	No data
100 % ODOR DETECTION:	No data

REGULATIONS

National Primary Ambient Air Quality Standards
1.5 ug/M3 maximum arithmetic mean averaged over a calendar year
National Secondary Ambient Air Quality Standards
same as primary standard

DOT hazard class:	6.1 POISON
DOT guide:	53
Identification number:	UN2291
DOT shipping name:	LEAD COMPOUNDS, SOLUBLE, N.O.S.
Packing group:	III
Label(s) required:	KEEP AWAY FROM FOOD
Special provisions:	
Packaging exceptions:	173.153
Non bulk packaging:	173.213
Bulk packaging:	173.240
Quantity limitations-	
Passenger air/rail:	100 KG
Cargo aircraft only:	200 KG
Vessel stowage:	A
Other stowage provisions:	

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:Yes
CLEAN WATER ACT Sect.311:No
National Primary Drinking Water Regulations
Maximum Contaminant Levels (MCL): Treatment technique (12/07/92)
Maximum Contaminant Level Goals (MCLG): 0 mg/L (12/07/92)

CLEAN AIR ACT:	CAA '90 By category and CAA '77 Sect 109
EPA WASTE NUMBER:	D008
CERCLA REF:	Y
RQ DESIGNATION:	A 10 pounds (4.54 kg) CERCLA
SARA TPQ VALUE:	Not listed
SARA Sect. 312 categories:	Chronic toxicity: carcinogen Chronic toxicity: adverse effect to target organ after long period of exposure. Chronic toxicity: mutagen. Chronic toxicity: reproductive toxin.

LISTED IN SARA Sect 313: Yes
de minimus CONCENTRATION: 0.1 percent

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: ORM-B
Mailability: Domestic service and air transportation; shipper's declaration required
Max per parcel: 25 LBS; 5 LBS

NFPA CODES:
HEALTH HAZARD (BLUE): Unspecified

FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified
SPECIAL : Unspecified

------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ----------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
California Assembly Bill 2588 Air Toxics "Hot Spots" Chemicals.
California Assembly Bill 1807 Toxic Air Contaminants.
California Proposition 65 Developmental Toxin List
California Proposition 65 Female Reproductive Toxin List
California Proposition 65 Male Reproductive Toxin List
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
Clean Air Act Section 109 National Ambient Air Quality Standards List
Clean Air Act of November 15, 1990. List of pollutants.
Clean Water Act Section 307 Priority Pollutants
EPA TSCA Chemical Inventory List 1986
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
LEAD [7439-92-1]
Massachusetts Substance List.
New Jersey DEQ100 list for release reporting.
New Jersey Right To Know Substance List. (December 1987)
New Jersey Right to Know Substance List. Listed as a teratogen.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Specifically regulated substance. See 29 CFR 1910.1025
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
RCRA Toxicity Characteristics (TC) list dated March 29, 1990
SARA Section 313 Toxic Chemicals List

----------------------------- TOXICITY DATA --------------------------------

SHORT TERM TOXICITY: LASSITUDE, INSOMNIA, PALLOR, EYE GROUNDS, ANOREXIA, LOW-WEIGHT, MALNUTRITION, CONSTIPATION, ABDOMINAL PAIN, COLIC; HYPOTENSE, ANEMIA; GINGIVAL LEAD LINE; TREMBLING PARALYSIS WRIST. ** Source: 2

LONG TERM TOXICITY: unknown

TARGET ORGANS: gi,CNS,kidneys,blood,gingival tissue

SYMPTOMS: LASS, INSOM, PAL, EYE GROUNDS, ANOR, LOW-WT, MALNUT, CONSTI, ABDOM PAIN, COLIC; HYPOTENSE, ANEMIA, GINGIVAL LEAD LINE; TREM, PARA WRIST. METALLIC TASTE, INCREASED SALIVATION, PYORRHEA (FLOW OF MUCOUS). NEUROMUSCULAR: NUMBNESS AND TINGLING OF EXTREMITIES WITH SENSORY DISTRUBANCE, EXTENSOR WEAKNESS OF WRISTS AND ANKLES,

LOSS OF MUSCLE TONE, TREMOR INCREASED DEEP-TENDON REFLEXES, MUSCULAR CRAMPS AND ACHING, MUSCULAR ATROPHY. CNS: VISUAL DISTURBANCES, HEADACHE, NERVOUSNESS OF DEPRESSION, INSOMNIA, MENTAL CONFUSION, DELIRIUM. Source: NIOSHP, THIC

CONC IDLH: 100mg/m3 (ASPb)

NIOSH REL: <0.1 mg/M3 Air level to be maintained so that worker blood level remains <0.06 mg/100 g of whole blood

ACGIH TLV: TLV = 0.15mg/M3 as LEAD
ACGIH STEL: Not listed

OSHA PEL: Final Rule Limits:
TWA = See 29 CFR 1910.1025 and 1926.62
50 ug/M3

MAK INFORMATION: 0.1 calculated as total dust mG/M3
Substance with systemic effects, onset of effect over 2 hours: Peak = 10xMAK for 30 minutes, once per shift of 8 hours.
Risk of damage to the developing embryo or fetus must be considered probable. Damage cannot be excluded even when the MAK values are adhered to.

CARCINOGEN?: Y STATUS: See below

CARCINOGEN LISTS:

IARC: Carcinogen defined by IARC to be possibly carcinogenic to humans, but having (usually) no human evidence.
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Animal carcinogen. The chemical is carcinogenic in experimental animals at a relatively high dose, by routes or administration, at sites, or histological types, or by mechanisms that are not considered relevant to worker exposure.
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
orl-wmn TDLo:450 mg/kg/6Y JAMAAP 237,2627,77
PERIPHERAL NERVE AND SENSATION
Flaccid paralysis without anesthesia
BEHAVIORAL
Hallucinations, distorted perceptions

BEHAVIORAL
Muscle weakness

LD50 value: No LD50 in RTECS 1992

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

ipr-rat LDLo:1 gm/kg
orl-pgn LDLo:160 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical is a mammalian reproductive toxin.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)
orl-rat TDLo:790 mg/kg (multigenerations) AEHLAU 23,102,71
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-rat TDLo:1140 mg/kg (14D pre-21D post) PHMCAA 20,201,78
EFFECTS ON NEWBORN
Behavioral

orl-rat TDLo:520 mg/kg (7-22D preg/10D post) FEPRA7 37,394,78
EFFECTS ON NEWBORN

orl-rat TDLo:1100 mg/kg (1-22D preg) FEPRA7 37,895,78
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Blood and lymphatic systems(including spleen and marrow)
EFFECTS ON NEWBORN
Growth statistics(e.g.,reduced weight gain)

ihl-rat TCLo:10 mg/m3/24H (1-21D preg) ZHPMAT 165,294,77
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
SPECIFIC DEVELOPMENTAL ABNORMALITIES
Blood and lymphatic systems(including spleen and marrow)

ihl-rat TCLo:3 mg/m3/24H (1-21D preg) ZHPMAT 165,294,77
EFFECTS ON NEWBORN

orl-mus TDLo:1120 mg/kg (multigenerations) AEHLAU 23,102,71
EFFECTS ON EMBRYO OR FETUS
Fetotoxicity(except death,e.g.,stunted fetus)
EFFECTS ON EMBRYO OR FETUS
Fetal death

orl-mus TDLo:6300 mg/kg (1-21D preg) EXPEAM 31,1312,75
EFFECTS ON FERTILITY
Female fertility index
EFFECTS ON FERTILITY
Pre-implantation mortility

orl-mus TDLo:300 mg/kg (1-2D preg) TXCYAC 6,129,76
EFFECTS ON FERTILITY
Other measures of fertility

orl-mus TDLo:4800 mg/kg (1-16D preg) BECTA6 18,271,77
EFFECTS ON EMBRYO OR FETUS
Cytological changes(including somatic cell genetic material)

orl-dom TDLo:662 mg/kg (1-21W preg) TXAPA9 25,466,73
EFFECTS ON NEWBORN
Behavioral

California Prop 65: Developmental toxin (02/27/87)
Female reproductive toxin (02/27/87)
Male reproductive toxin (02/27/87)
Acceptable intake level-inhalation .5 ugD (01/01/94)
Carcinogen (10/01/92)

---------------------------- EPA's IRIS DATA SUMMARY ------------------------
Lead and compounds (inorganic); CASRN 7439-92-1 (04/01/92)

_II. CARCINOGENICITY ASSESSMENT FOR LIFETIME EXPOSURE

Substance Name -- Lead and compounds (inorganic)
CASRN -- 7439-92-1
Last Revised -- 05/01/91

Section II provides information on three aspects of the carcinogenic risk assessment for the agent in question; the U.S. EPA classification, and quantitative estimates of risk from oral exposure and from inhalation exposure. The classification reflects a weight-of-evidence judgment of the likelihood that the agent is a human carcinogen. The quantitative risk estimates are presented in three ways. The slope factor is the result of application of a low-dose extrapolation procedure and is presented as the risk per (mg/kg)/day. The unit risk is the quantitative estimate in terms of either risk per ug/L drinking water or risk per ug/cu.m air breathed. The third form in which risk is presented is a drinking water or air concentration providing cancer risks of 1 in 10,000, 1 in 100,000 or 1 in 1,000,000. Background Document 2

(Service Code 5) provides details on the rationale and methods used to derive the carcinogenicity values found in IRIS. Users are referred to Section I for information on long-term toxic effects other than carcinogenicity.

__II.A. EVIDENCE FOR CLASSIFICATION AS TO HUMAN CARCINOGENICITY

___II.A.1. WEIGHT-OF-EVIDENCE CLASSIFICATION

Classification -- B2; probable human carcinogen

Basis -- Sufficient animal evidence. Ten rat bioassays and one mouse assay have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. Animal assays provide reproducible results in several laboratories, in multiple rat strains with some evidence of multiple tumor sites. Short term studies show that lead affects gene expression. Human evidence is inadequate.

___II.A.2. HUMAN CARCINOGENICITY DATA

Inadequate. There are four epidemiologic studies of occupational cohorts exposed to lead and lead compounds. Two studies (Dingwall-Fordyce and Lane, 1963; Nelson et al., 1982) did not find any association between exposure and cancer mortality. Selevan et al. (1985), in their retrospective cohort mortality study of primary lead smelter workers, found a slight decrease in the total cancer mortality (SMR=95). Apparent excesses were observed for respiratory cancer (SMR=111, obs=41, $p>0.05$) and kidney cancer (SMR=204, obs=6, $p>0.05$). Cooper and Gaffey (1975) and Cooper (1985 update) performed a cohort mortality study of battery plant workers and lead smelter workers. They found statistically significant excesses for total cancer mortality (SMR=113, obs=344), stomach cancer (SMR=168, obs=34), and lung cancer (SMR=124, obs=109) in the battery plant workers. Although similar excesses were observed in the smelter workers, they were not statistically significant. Cooper and Gaffey (1975) felt it was possible that individual subjects were monitored primarily on the basis of obvious signs of lead exposure, while others who showed no symptoms of lead poisoning were not monitored.

All of the available studies lacked quantitative exposure information, as well as information on the possible contribution from smoking. All studies also included exposures to other metals such as arsenic, cadmium, and zinc for which no adjustment was done. The cancer excesses observed in the lung and stomach were relatively small (<200). There was no consistency of site among the various studies, and no study showed any dose-response relationship. Thus, the available human evidence is considered to be inadequate to refute or demonstrate any potential carcinogenicity for humans from lead exposure.

___II.A.3. ANIMAL CARCINOGENICITY DATA

Sufficient. The carcinogenic potential of lead salts (primarily phosphates and acetates) administered via the oral route or by injection has been demonstrated in rats and mice by more than 10 investigators. The most characteristic cancer response is bilateral renal carcinoma. Rats given lead acetate or subacetate orally have developed gliomas, and lead subacetate also produced lung adenomas in mice after i.p. adminstration. Most of these investigations found a carcinogenic response only at the highest dose. The lead compounds tested in animals are almost all soluble salts. Metallic lead, lead oxide and lead tetralkyls have not been tested adequately. Studies of inhalation exposure have not been located in the literature.

Azar et al. (1973) administerd 10, 50, 100, and 500 ppm lead as lead acetate in dietary concentrations to 50 rats/sex/group for 2 years. Control rats (100/sex) received the basal laboratory diet. In a second 2-year feeding study, 20 rats/group were given diets containing 0, 1000, and 2000 ppm lead as lead acetate. No renal tumors were reported in the control groups or in treated animals of either sex receiving 10 to 100 ppm. Male rats fed 500, 1000, and 2000 ppm lead acetate had an increased renal tumor incidence of 5/50, 10/20, and 16/20, while 7/20 females in the 2000-ppm group developed renal tumors.

The Azar et al. (1973) study is limited by the lack of experimental detail. The possibility of environmental contamination from lead in the air or drinking water was not mentioned. The strains of rats used were not specified in the study, but the Health Effects Assessment for Lead (U.S. EPA, 1984) indicates the rats were Wistar strain. The weight gain at 1000 and 2000 ppm was reported to be depressed, but details were not given.

Kasprzak et al. (1985), in investigating the interaction of dietary calcium on lead carcinogenicity, fed 1% lead subacetate (8500 ppm Pb) to male Sprague-Dawley rats in the diet for 79 weeks. Of the rats surviving (29/30) in this treatment group beyond 58 weeks, 44.8% had renal tumors. Four rats had adenocarcinomas; the remainaing nine had adenomas. Bilateral tumors were noted. No renal tumors were noted among the controls.

As part of a study to determine interactions between sodium nitrite, ethyl urea and lead, male Sprague-Dawley rats were given lead acetate in their drinking water for 76 weeks (Koller et al., 1986). The concentration of lead was 2600 ppm. No kidney tumors were detected among the 10 control rats. Thirteen of 16 (81%) lead-treated rats had renal tubular carcinoma; three tumors were detected at 72 weeks and the remainder detected at the termination of the study.

Van Esch and Kroes (1969) fed basic lead acetate at 0, 0.1%, and 1.0% in the diet to 25 Swiss mice/sex/group for 2 years. No renal tumors developed in the control group, but 6/25 male mice of 0.1% basic lead acetate group had renal tumors (adenomas and carcinomas combined). In the 1.0% group, one female had a renal tumor. The authors thought that the low incidence in the 1.0% group was due to early mortality.

Hamsters given lead subacetate at 0.5% and 1% in the diet had no significant renal tumor response (Van Esch and Kroes, 1969).

___II.A.4. SUPPORTING DATA FOR CARCINOGENICITY

Lead acetate induces cell transformation in Syrian hamster embryo cells (DiPaolo et al., 1978) and also enhances the incidence of simian adenovirus induction. Lead oxide showed similar enhanced adenovirus induction (Casto et al., 1979).

Under certain conditions lead compounds are capable of inducing chromosomal aberrations in vivo and in tissue cultures. Grandjean et al. (1983) showed a relationship between SCE and lead exposure in exposed workers. Lead has been shown, in a number of DNA structure and function assays, to affect the molecular processes associated with the regulation of gene expression (U.S. EPA, 1986).

__II.B. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM ORAL EXPOSURE

Not available.

Quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used.

__II.C. QUANTITATIVE ESTIMATE OF CARCINOGENIC RISK FROM INHALATION EXPOSURE

Not available.

__II.D. EPA DOCUMENTATION, REVIEW, AND CONTACTS (CARCINOGENICITY ASSESSMENT)

___II.D.1. EPA DOCUMENTATION

U.S. EPA. 1984. Health Effects Assessment for Lead. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Cincinnati, OH, for the Office of Emergency and Remedial Response, Washington, DC. EPA/540/1-86/055. NTIS PB85-163996/AS.

U.S. EPA. 1986. Air Quality Criteria Document for Lead. Volumes III, IV. Prepared by the Office of Health and Environmental Assessment, Environmental Criteria and Assessment Office, Research Triangle Park, NC, for the Office of Air Quality Planning and Standards. EPA-600/8-83/028dF.

U.S. EPA. 1987. Preliminary review of the carcinogenic potential of lead associated with oral exposure. Prepared by the Office of Health and Environmental Assessment, Carcinogenic Assessment Group, Washington DC, for the Office of Drinking Water, Office of Solid Waste and the Office of Emergency and Remedial Response (Superfund). OHEA-C-267. Internal Review Draft.

___II.D.2. REVIEW (CARCINOGENICITY ASSESSMENT)

The review of the carcinogenic potential of lead associated with oral exposure has received Agency review.

The 1986 Air Quality Criteria Document for Lead has received Agency and External Review.

Agency Work Group Review: 05/04/88

Verification Date: 05/04/88

___II.D.3. U.S. EPA CONTACTS (CARCINOGENICITY ASSESSMENT)

William Pepelko / ORD -- (202)260-5898 / FTS 260-5898

James Cogliano / ORD -- (202)260-9243 / FTS 260-9243

---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
At the end of each work shift.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes contaminated.

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (LEAD)
Not in excess of 0.5 mg/M3: Half-mask, air-purifying respirator equipped with high efficiency filters.
Not in excess of 2.5 mg/M3: Full facepiece air-purifying respirator equipped with high-efficiency filters.
Not in excess of 50 mg/M3: (1) Any powered, air-purifying respirator with high efficiency filters; or (2) Half-mask supplied-air respirator operated in positive-pressure mode.
Not in excess of 100 mg/M3: Supplied air respirator with full facepiece hood, or helmet or suit and operated in positive pressure mode.
Unknown concentration or Firefighting: Full facepiece, self-contained breathing apparatus operated in postive-pressure mode.

FIRST AID SOURCE: NIOSH
EYE: irr immed
SKIN: soap flush promptly
INHALATION: art resp
INGESTION: water, vomit

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: LEAD COMPOUNDS, SOLUBLE, N.O.S.
DOT ID NUMBER: UN2291

ERG93 GUIDE 53

POTENTIAL HAZARDS

*HEALTH HAZARDS
Poisonous if swallowed.
Inhalation of dust or mist may be poisonous.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.
*FIRE OR EXPLOSION
Some of these materials may burn, but none of them ignites readily.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. CALL Emergency Response

Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.

*FIRE

Small Fires: Dry chemical, CO2, water spray or regular foam.

Large Fires: Water spray, fog or regular foam.

Move container from fire area if you can do it without risk.

*SPILL OR LEAK

Do not touch or walk through spilled material; stop leak if you can do it without risk.

Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.

Small Dry Spills: With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

Large Spills: Dike far ahead of liquid spill for later disposal.

*FIRST AID

Move victim to fresh air; call emergency medical care. In case of contact with material, immediately flush skin or eyes with running water for at least 15 minutes. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

------------------------------- IDENTIFIERS -------------------------------

CHEMTOX RECORD 1843 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	PETROLEUM SPIRITS		
SYNONYMS:	BENZINE; BENZOLINE; CANADOL; HERBITOX; LIGROIN; MINERAL SPIRITS; MINERAL SPIRITS NO. 10; MINECAL THINNER; MINERAL TURPENTINE; NAPHTHA, V.M. AND P.; PAINTERS' NAPHTHA; REFINED SOLVENT NAPHTHA; SOLVENT NAPHTHA		
CAS:	8030-30-6	RTECS:	SE7555000
FORMULA:	W99	MOL WT:	APPX.110
WLN:	A10-15		
CHEMICAL CLASS:	Paraffin		

See other identifiers listed below under Regulations.

------------------------------- PROPERTIES -------------------------------

PHYSICAL DESCRIPTION: reddish-brown, mobile liquid with an aromatic odor

BOILING POINT:	433.15-493.15 K	160-220 C	320-428 F
MELTING POINT:	NA		
FLASH POINT:	310.93-315.93 K	37.78-42.78 C	100-109 F
AUTO IGNITION:	Not available		
VAPOR PRESSURE:	<5 mm Hg @ 20 C		
UEL:	~		
LEL:	~		
VAPOR DENSITY:	No data		
EVAPORATION RATE:	5.53(n-BUTYL ACETATE=1)		
SPECIFIC GRAVITY:	0.89-0.97		
DENSITY:			
WATER SOLUBILITY:	INSOLUBLE		
INCOMPATIBILITIES:			

REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	None reported other than possible unburned vapors
ODOR DETECTED AT (ppm):	Unknown
ODOR DESCRIPTION:	No data
100 % ODOR DETECTION:	No data

------------------------------- REGULATIONS -------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	26
Identification number:	UN1271

DOT shipping name: Petroleum spirit
Packing group: I - II
Label(s) required: FLAMMABLE LIQUID - FLAMMABLE LIQUID
Special provisions: T8■B1,T8
Packaging exceptions: 173.150■150
Non bulk packaging: 173.201■202
Bulk packaging: 173.243■242
Quantity limitations-
Passenger air/rail: 1 L■5 L
Cargo aircraft only: 30 L■60 L
Vessel stowage: ■E, B
Other stowage provisions:

STCC NUMBER: ,

CLEAN WATER ACT Sect.307: No
CLEAN WATER ACT Sect.311: No
CLEAN AIR ACT: Not listed
EPA WASTE NUMBER: D001
CERCLA REF: Not listed
RQ DESIGNATION: Not listed
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Fire hazard: flammable.

UNITED STATED POSTAL SERVICE MAILABILITY:
Hazard class: Not given
Mailability: Nonmailable
Max per parcel: 0

NFPA CODES:
HEALTH HAZARD (BLUE): Unspecified
FLAMMABILITY (RED) : Unspecified
REACTIVITY (YELLOW): Unspecified
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

Canadian Domestic Substances List
DOT Hazardous Materials Table. 49 CFR 172.101
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
PETROLEUM SPIRITS [8030-30-6]
Pennsylvania Hazardous Substance List
RCRA Hazardous Waste

----------------------------- TOXICITY DATA ----------------------------------

SHORT TERM TOXICITY: Unknown

LONG TERM TOXICITY: unknown

TARGET ORGANS:

SYMPTOMS: Source:

CONC IDLH: 1000PPM

NIOSH REL:

ACGIH TLV: Not listed
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 100 ppm(400 mg/m3 /15Mmg/M3)
Final Rule Limits:
TWA = 100 ppm (400 mg/M3)

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:
IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

HUMAN TOXICITY DATA: (Source: NIOSH RTECS)
* ihl-hmn LCLo:3 pph/5M TABIA2 3,231,33

LD50 value: orl-rat LD50:>5 gm/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:>5 gm/kg
ihl-rat LCLo:1600 ppm/6H
ihl-mus LCLo:10600 mg/m3/6H
skn-rbt LD50:>3 gm/kg
ipr-mam LDLo:2500 mg/kg

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

---------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
OSHA (PETROLEUM SPIRITS)
1000 ppm: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance causes eye irritation or damage; eye protection needed. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
2500 ppm: Any supplied-air respirator operated in a continuous flow mode. * Substance causes eye irritation or damage; eye protection needed.
5000 ppm: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
10000 ppm: Any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: NIOSH
EYE: None given
SKIN: None given
INHALATION: None given
INGESTION: None given

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: Petroleum spirit
DOT ID NUMBER: UN1271

ERG93 GUIDE 26

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.
Runoff to sewer may create fire or explosion hazard.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may give off poisonous gases and cause water pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO2, water spray or alcohol-resistant foam. Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane. Large Fires: Water spray, fog or alcohol-resistant foam. Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area.
Stop leak if you can do it without risk.
Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and

water. Remove and isolate contaminated clothing and shoes at the site.

CHEMTOX DATA

--------------------------------- IDENTIFIERS ---------------------------------

CHEMTOX RECORD 2293 LAST UPDATE OF THIS RECORD: 03/09/95

NAME:	STODDARD SOLVENT		
SYNONYMS:	DRY CLEANING SAFETY SOLVENT; MINERAL SPIRITS; VARNOLINE; NAPHTHA SAFETY SOLVENT; WHITE SPIRITS		
CAS:	8052-41-3	RTECS:	WJ8925000
FORMULA:	C9H20	MOL WT:	144 (VARIES)
WLN:			
CHEMICAL CLASS:			

See other identifiers listed below under Regulations.

--------------------------------- PROPERTIES ---------------------------------

PHYSICAL DESCRIPTION: colorless watery liquid with a gasoline-like odor.

BOILING POINT:	427.04-475.37 K	153.8-202.2 C	309-395.9 F
MELTING POINT:	NA		
FLASH POINT:	312.04-316.48 K	38.89-43.33 C	102-109.9 F
AUTO IGNITION:	505.37 K	232.2 C	450 F

VAPOR PRESSURE:	ABOUT 2 MM
UEL:	~
LEL:	0.8 %
IONIZATION POTENTIAL (eV):	6.98
VAPOR DENSITY:	No data
SPECIFIC GRAVITY:	0.78
DENSITY:	0.78 g/cc or 7.254 lb/gal
WATER SOLUBILITY:	INSOLUBLE
INCOMPATIBILITIES:	strong oxidizers
REACTIVITY WITH WATER:	No data on water reactivity
REACTIVITY WITH COMMON MATERIALS:	No data
STABILITY DURING TRANSPORT:	No Data
NEUTRALIZING AGENTS:	No data
POLYMERIZATION POSSIBILITIES:	No data
TOXIC FIRE GASES:	ACRID FUMES, MAY EXPLODE
ODOR DETECTED AT (ppm):	1 PPM
ODOR DESCRIPTION:	KEROSENE-LIKE Source:NYDH
100 % ODOR DETECTION:	No data

--------------------------------- REGULATIONS ---------------------------------

DOT hazard class:	3 FLAMMABLE LIQUID
DOT guide:	27
Identification number:	UN1993
DOT shipping name:	FLAMMABLE LIQUID, N.O.S. (STODDARD SOLVENT)
Packing group:	III
Label(s) required:	FLAMMABLE LIQUID

Special provisions: B1,B52,T7,T30
Packaging exceptions: 173.150
Non bulk packaging: 173.203
Bulk packaging: 173.242
Quantity limitations-
Passenger air/rail: 60 L
Cargo aircraft only: 220 L
Vessel stowage: A
Other stowage provisions:

STCC NUMBER: Not listed

CLEAN WATER ACT Sect.307:No
CLEAN WATER ACT Sect.311:No
CLEAN AIR ACT: Not listed
EPA WASTE NUMBER: D001
CERCLA REF: Not listed
RQ DESIGNATION: Not listed
SARA TPQ VALUE: Not listed
SARA Sect. 312
categories:
Acute toxicity: Irritant
Acute toxicity: adverse effect to target organs.
Fire hazard: flammable.

UNITED STATED POSTAL SERVICE MAILABILITY:
Not given

NFPA CODES:
HEALTH HAZARD (BLUE): (0) No unusual health hazard.
FLAMMABILITY (RED) : (2) This material must be moderately heated before ignition will occur.
REACTIVITY (YELLOW): (0) Stable even under fire conditions.
SPECIAL : Unspecified

-------------- SUMMARY OF REGULATORY LISTS THIS SUBSTANCE APPEARS ON ---------

ACGIH TLV list "Threshold Limit Values for 1992-1993"
Canadian Domestic Substances List
Canadian Ingredient Disclosure List. 20/01/88 Canada Gazette part II, Vol 122.
EPA TSCA Chemical Inventory List 1989
EPA TSCA Chemical Inventory List 1990
EPA TSCA Chemical Inventory List 1992
EPA TSCA Test Submission (TSCATS) Database - April 1990
EPA TSCA Test Submission (TSCATS) Database - September 1989
Massachusetts Substance List.
New Jersey Right To Know Substance List. (December 1987)
OSHA Air Contaminant (Table Z-1-A). 54 FR 4332, Jan. 19, 1989 and revised.
OSHA Process Safety Rule chemical with a TQ. Effective May 26, 1992

Pennsylvania Hazardous Substance List
RCRA Hazardous Waste
STODDARD SOLVENT [8052-41-3]
Wisconsin Air Toxics Control Regulation NR-445 (December 1988)

----------------------------- TOXICITY DATA ---------------------------------

SHORT TERM TOXICITY: INHALATION: exposure to levels above 2400 mg/m3 may cause headache, dizziness and nose and throat irritation. more severe exposures may cause nausea and vomiting, a feeling of intoxication, weakness, muscle twitches and in extreme cases convulsions, unconsciousness and death. SKIN: contact with liquid may cause irritation and drying of skin. this can result in dermatitis. Eyes: contact with liquid or vapor levels of 900 mg/m3 to 2400 mg/m3 may cause irritation and tearing. INGESTION: small amounts may cause headache, dizziness, nausea, vomiting, intoxication, weakness, muscle twitches, convulsions and unconsciousness. as little as 3 ounces may be fatal. if liquid is breathed into the lungs as little as 1 ounce may cause death due to respiratory failure.(NYDH)

LONG TERM TOXICITY: prolonged or repeated contact with liquid may cause drying, and irritation of the skin and jaundice. exposure to vapor may cause eye, nose and throat irritation, fatigue, headaches, anemia and damage to the liver and bone marrow.(NYDH)

TARGET ORGANS: eyes, skin, respiratory system, CNS.

SYMPTOMS: HIGH CONCENTRATION OF VAPORS MAY CAUSE INTOXICATION. IF LIQUID IS SWALLOWED, IT MAY GET INTO LUNGS BY ASPIRATION; NOT VERY IRRITATING TO SKIN OR EYES. IRRITATION OF EYES, NOSE, THROAT, DIZZINESS, DERMATITIS. Source: HTHC, CHRIS

CONC IDLH: 20000mg/M3

NIOSH REL: 350 mg/M3 Time weighted averages for 8-hour exposure
1800 mg/M3 Ceiling exposures which shall at no time be exceeded

ACGIH TLV: TLV = 100ppm(525 mg/M3)
ACGIH STEL: Not listed

OSHA PEL: Transitional Limits:
PEL = 500 ppm(2900mg/M3)
Final Rule Limits:
TWA = 100 ppm (525 mg/M3)

** REFERENCE: NIOSH

RECOMMENDED RESPIRATION PROTECTION Source: NIOSH POCKET GUIDE (85-114)
NIOSH (STODDARD SOLVENT)
3500 mg/M3: Any supplied-air respirator. * Substance reported to cause eye irritation or damage may require eye protection. / Any self-contained breathing apparatus. * Substance reported to cause eye irritation or damage may require eye protection. / Any chemical cartridge respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation or damage may require eye protection.
5900 mg/M3: Any powered air-purifying respirator with organic vapor cartridge(s). * Substance reported to cause eye irritation or damage may require eye protection. / Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
14750 mg/M3: Any supplied-air respirator operated in a continuous flow mode. * Substance reported to cause eye irritation or damage may require eye protection.
29500 mg/M3: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any self-contained breathing apparatus with a full facepiece. / Any supplied-air respirator with a full facepiece.
EMERGENCY OR PLANNED ENTRY IN UNKNOWN CONCENTRATIONS OR IDLH CONDITIONS.: Any self-contained breathing apparatus with full facepiece and operated in a pressure-demand or other positive pressure mode. / Any supplied-air respirator with a full facepiece and operated in pressure-demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
ESCAPE: Any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister. / Any appropriate escape-type self-contained breathing apparatus.

FIRST AID SOURCE: DOT Emergency Response Guide 1990.
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

---------------------------- INITIAL INCIDENT RESPONSE ----------------------

US Department of Transportation Guide to Hazardous Materials Transport Information - Publication DOT 5800.5 (1990).
DOT SHIPPING NAME: FLAMMABLE LIQUID, N.O.S. (STODDARD SOLVENT)
DOT ID NUMBER: UN1993

ERG93 GUIDE 27

POTENTIAL HAZARDS

*FIRE OR EXPLOSION
Flammable/combustible material; may be ignited by heat, sparks or flames.
Vapors may travel to a source of ignition and flash back.
Container may explode in heat of fire.
Vapor explosion hazard indoors, outdoors or in sewers.

MAK INFORMATION: Not listed

CARCINOGEN?: N STATUS: See below

CARCINOGEN LISTS:

IARC: Not listed
MAK: Not listed
NIOSH: Not listed
NTP: Not listed
ACGIH: Not listed
OSHA: Not listed

LD50 value: orl-rat LD50:>5 gm/ kg

OTHER SPECIES TOXICITY DATA: (Source: NIOSH RTECS 1992)

orl-rat LD50:>5 gm/kg
ihl-rat LC50:>5500 mg/m3/4H
ihl-dog LC :>8 gm/m3/8H-C
ihl-cat LCLo:1700 ppm/7H

IRRITATION DATA: (Source: NIOSH RTECS 1992)

Reproductive toxicity (1992 RTECS):
This chemical has no known mammalian reproductive toxicity.

REPRODUCTIVE TOXICITY DATA (1992 RTECS)

California Prop 65: Not listed

--------------------------- PROTECTION AND FIRST AID ------------------------

PROTECTION SUGGESTED
FROM THE CHRIS MANUAL:
goggles or face shield (as for gasoline).

NIOSH POCKET GUIDE TO CHEMICAL HAZARDS:

** WEAR APPROPRIATE EQUIPMENT TO PREVENT:
Repeated or prolonged skin contact.

** WEAR EYE PROTECTION TO PREVENT:
Reasonable probability of eye contact.

** EXPOSED PERSONNEL SHOULD WASH:
Promptly when skin becomes wet.

** REMOVE CLOTHING:
Promptly remove non-impervious clothing that becomes wet.

Runoff to sewer may create fire or explosion hazard.
Material may be transported hot.
*HEALTH HAZARDS
May be poisonous if inhaled or absorbed through skin.
Vapors may cause dizziness or suffocation.
Contact may irritate or burn skin and eyes.
Fire may produce irritating or poisonous gases.
Runoff from fire control or dilution water may cause pollution.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection. *Isolate for 1/2 mile in all directions if tank, rail car or tank truck is involved in fire. CALL Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, CALL CHEMTREC AT 1-800-424-9300. If water pollution occurs, notify the appropriate authorities.
*FIRE
Small Fires: Dry chemical, CO_2, water spray or regular foam.
Large Fires: Water spray, fog or regular foam.
Move container from fire area if you can do it without risk. Apply cooling water to sides of containers that are exposed to flames until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire.
*SPILL OR LEAK
Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk. Water spray may reduce vapor; but it may not prevent ignition in closed spaces.
Small Spills: Take up with sand or other noncombustible absorbent material and place into containers for later disposal.
Large Spills: Dike far ahead of liquid spill for later disposal.
*FIRST AID
Move victim to fresh air and call emergency medical care; if not breathing, give artificial respiration; if breathing is difficult, give oxygen. In case of contact with material, immediately flush eyes with running water for at least 15 minutes. Wash skin with soap and water. Remove and isolate contaminated clothing and shoes at the site.

Attachment B

Drilling Safety Guide

Drilling Safety Guide

EnSafe is concerned about employee safety while working on or around drill rigs as well as when traveling to and from a drilling site, moving the drill rig and tools from location to location on a site and during maintenance of the drill rig. Every drill crew will have a designated safety supervisor. The safety supervisor will have the responsibility for ensuring that all drilling operations are conducted in a safe manner. All personnel working on, with, or around a drill rig will be under the jurisdiction of the rig safety supervisor.

Drill Rig Safety Supervisor

The safety supervisor for the drill crew will be the drill rig operator. However, the EnSafe safety officer still maintains the overall safety responsibility for the site. The drill crew safety supervisor is a direct representative of the site health and safety supervisor and will report any safety problems directly to the site health and safety officer. The drill rig safety supervisor will:

- Be the leader in using proper personal protective equipment. He/she will set an example for other personnel to follow.

- Enforce the requirements of the health and safety plan and take appropriate actions when other personal are not following the requirements of the health and safety plan.

- Ensure that all drill rig and associated drill rig equipment is properly maintained.

- Ensure that all drill rig operating personnel are thoroughly familiar with the drill operations.

- Inspect the drill rig and associated drill rig equipment for damage before starting drilling operations. Check for structural damage, loose bolts or nuts, correct tension in chains and cables, loose or missing guards or protective covers, fluid leaks, damaged hoses and or damaged pressure gauges and pressure relief valves.

- Test all emergency and warning devices such as emergency shut-down switches at least daily (prior to starting drilling operations). Drilling will not be permitted until all emergency and warning devices are functioning.

- Conduct a safety briefing daily before starting drilling operations. Any new employee will receive a copy of the drilling operations safety manual, and the drill rig manufacturer's operating and maintenance manual.

- Ensure that each employee reads and understands the drill rig manufacturer's operating and maintenance manual.

- Observe the mental, emotional, and physical capabilities of each worker.

- Ensure that each drill rig has a first aid kit and fire extinguisher.

- Maintain a list of emergency contact telephone numbers. This list will be posted in a prominent location and each drill rig employee will be informed of the lists location.

Drill Rig Personnel Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling, drill rig personal protective equipment will include the following:

- Hard hat
- Safety shoes with steel toe and steel shank (or equivalent)
- Gloves

- Safety glasses with side shields
- Close fitting but comfortable clothes
- Hearing protection

It is important that clothing does not have loose ends, straps, draw strings or belts, or other unfastened parts that might become caught in or on a rotating or translating part of the drill rig.

Rings, necklaces, or other jewelry will not be worn during drilling operations.

Additional protective equipment may be required by the site specific health and safety plan.

Drill Rig Housekeeping

The following housekeeping measures must be taken for all drilling operations.

- Suitable storage locations will be provided for all tools, materials and supplies. The storage should be conveniently located and will provide for safe handling of all supplies.

- Drill tools, supplies, and materials will not be transported on the drill rig unless the drill rig is designed and equipped to carry drill tools, supplies, and materials.

- Pipe, drill rods, casing, augers, and similar drilling tools when stored will be stacked in a manner that will prevent spreading, rolling, or sliding.

- Penetration or other driving hammers will be secured to prevent movement when not in use.

- Work areas, platforms, walkways, scaffolding, and other access ways will be kept free of materials, debris and obstructions and substances such as ice, grease, or oil that could cause a surface to become slick or otherwise hazardous.

- Never store gasoline in a non-approved container. Red, non-sparking, vented containers marked with the word gasoline will be used. The fill spout will have a flame arrester.

- Prior to drilling, adequate site clearing and leveling will be performed to accommodate the drill rig and supplies and to provide a safe working area. Drilling will not be started when tree limbs, unstable ground or site obstructions cause unsafe tool handling conditions.

Maintenance Safety

Well maintained drilling equipment makes drilling operations safer. When performing equipment/tool maintenance, the follow safety precautions will be followed:

- Safety glasses will be worn when maintenance is performed on drill rigs or drilling tools.

- Shut down the drill rig engine to make repairs or adjustments to the rig or to lubricate fittings (except to make repairs or adjustments that can only be made while the engine is running).

- Always block the wheels or lower the leveling jacks or both. Set the hand brake before working under a drill rig.

- Release all pressure on hydraulic systems, the drilling fluid system, and the air operating system of the drill rig prior to performing maintenance.

- Use extreme caution when opening drain plugs and radiator caps and other pressurized plugs and caps.

- Allow time for the engine and exhaust to cool before performing maintenance on these systems.

- Never weld or cut on or near the fuel tank.

- Do not use gasoline or other volatile or flammable liquids as a cleaning agent.

- Follow the manufacturer's recommendations for quantity and type of lubricants, hydraulic fluids and coolants.

- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps and chains or cables that have been removed during maintenance.

- Perform a safety inspection prior to starting drilling equipment after maintenance is performed.

Safe Use of Hand Tools

There are a large number of hand tools that can be used on or around a drill rig. The most important rule of hand tools is to use a tool for its intended purpose. The following are a few general and specific safety rules to follow when using hand tools.

- When using a hammer, wear safety glasses and require all others around you to wear safety glasses.

- When using a chisel, wear safety glasses and require all others around you to wear safety glasses.

- Keep all tools cleaned and stored in an orderly manner.

- Use wrenches on nuts, not pliers.

- Use screwdrivers with blades that fit the screw slot.

- When using a wrench on a tight nut, use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and apply force to the wrench with both hands when possible and with both feet firmly placed. Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing. Check the place where you may fall for sharp objects.

- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches will be wire brushed frequently to prevent accumulation of dirt and grease which cause wrenches to slip.

- Never use pipe wrenches in place of a rod holding device.

- Replace hock and heel jaws when visibly worn.

- When breaking tool joints on the ground or on a drilling platform, position hands so that fingers will not be smashed between the wrench handle and the ground or the platform if the wrench were to slip or the joint suddenly to let go.

Safety During Drilling Operations

- Do not drive a drill rig from hole to hole with the mast (derrick) in the raised position.

- Before raising the mast, look up to check for overhead obstructions.

- Before raising the mast, all drill rig personnel (except the person raising the mast) and visitors will be cleared from the area immediately to the rear and sides of the mast. All drill rig personnel and visitors will be informed that the mast is being raised prior to raising the mast.

- All drill rig personnel and visitors will be instructed to stand clear of the drill rig immediately prior to and during starting of the engine.

- All gear boxed will be in the neutral position, all hoist levers will be disengaged, all hydraulic levers will be in the non-actuating positions, and the cathead rope will not be on the cathead before starting the drill rig engine.

- The drill rig must be leveled and stabilized with leveling jacks and/or solid cribbing before the mast is raised. The drill rig will be leveled if settling occurs after initial set up.

- The mast will be lowered only when the leveling jacks are down. The leveling jacks must be in the down position until the mast is completely lowered.

- Secure and/or lock the mast according to the drill rig manufacturer's recommendations before starting drilling operations.

- The initial 4 feet will be drilled manually (via post hole digger or hand auger) to ensure clearance from unmarked utilities, unless approval is obtained from the project manager and project health and safety officer. If manual drilling is not possible, metal-detecting equipment will be used to locate utilities at drilling intervals of one foot until a depth of 4 feet is obtained.

- The drill rig must only be operated from the control position. If the operator must leave the control position, the rotary drive and the feed control must be placed in the neutral position. The drill engine will be shut down when the operator leaves the vicinity of the drill rig.

- Throwing or dropping of tools is not permitted. All tools will be carefully passed by hand between personnel or a hoist line will be used.

- When drilling within an enclosed area, ensure that fumes are exhausted out of the area. Exhaust fumes can be toxic and may not be detected by smell.

- Clean mud and grease from boots before mounting the drill platform. Use hand holds and railings. Watch for slippery ground when dismounting from the drill platform.

- Do not touch any metal parts of the drill rig with exposed flesh during freezing weather. Freezing of moist skin to metal can occur almost instantaneously.

- All unattended id,<,d, must be covered or otherwise protected to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole.

- Do not attempt to use one or both hands to carry tools when climbing ladders.

Working on Derrick Platforms

- When working on a derrick platform, us a safety belt and a lifeline. The safety belt will be at least 4 inches wide and will fit snugly but comfortably. The lifeline, will be less than 6 feet long and attached to the derrick.

- The safety belt and lifeline will be strong enough to withstand the dynamic force of a 250 pound weight falling 6 feet.

- A safety climbing device will be used when climbing to a derrick platform that is higher than 20 feet.

- The lifeline will be fastened to the derrick just above the derrick platform to a structural member that is not attached to the platform or to other lines or cables supporting the platform.

- Tools will be securely attached to the platform with safety lines. Do not attach a tool to a line attached to the wrist or other body part.

- When working on a derrick platform, do not guide drill rods or pipe into racks or other supports by taking hold of a moving hoist line or a traveling block.

- Derrick platforms over 4 feet above the ground will have toe boards and safety railings.

Working on the Ground

- Workers on the ground must avoid going under elevated platforms.

- Terminate drilling operations and if possible lower the mast during an electrical storm.

- Overhead and buried utilities must be located and marked on all boring location plans and boring assignment sheets.

- When there are overhead electrical power lines at or near a drilling site or project, consider all wire to be charged and dangerous.

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entry. Call the utility to have them lift the power lines or to deenergize the power.

- Operations adjacent to overhead lines are prohibited unless on of the following conditions is satisfied:

  — Power has been shut off and positive means taken to prevent the lines from being energized.

  — Equipment, or any part, does not have the capability of coming within the following minimum clearance from energized overhead lines, or the equipment has been positioned and blocked to assure no part, including cables can come within the following minimum clearances:

Power Lines Nominal System kv	Minimum Required Clearance
0 - 50	10 feet
51 - 100	12 feet
101 - 200	15 feet
201 - 300	20 feet
301 - 500	25 feet
501 - 750	35 feet
751 - 1000	45 feet

- While in transit with boom lowered and no load, the equipment clearance will be a minimum of 4 feet for voltages less than 50kv, 10 feet for voltages 51kv to 345kv, and 16 feet for voltages over 345kv.

- Before working near transmitter towers where an electrical charge can be induced in the equipment or materials being handled, the transmitter will be de-energized. The following precautions will be taken to dissipate induced voltages:

  — The equipment will be provided with an electrical ground to the upper rotating structure supporting the boom.

  — Ground jumper cables will be attached to materials being handled by boom equipment when electrical charge may be induced while working near energized transmitters. Crews will be provided nonconductive poles having large alligator clips or other similar protection to attach the ground cable to the load. Insulating gloves will be used.

- Continue to watch overhead power lines. Both hoist lines and overhead power lines can be moved toward each other by the wind.

- If there are any questions concerning drill rig operations on a site in the vicinity of overhead power lines, call the power company. The power company will provide expert advice as a public service.

- Look for warning signs indicating underground utilities. Underground utilities may be located a considerable distance away from the warning sign. Call the utility and jointly determine the precise location of all underground utility lines, mark and flag the locations and determine the specific precautions to be taken to ensure safe drilling operations.

Wire Rope Safety

- All wire ropes and fittings will be visually inspected at least once a week for abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware.

- Wire ropes must be replaced when inspection indicates excessive damage. The **Wire Rope User's Manual** may be used as a guide for determining excessive damage.

- Wire ropes that have not been used for a period of a month or more will be thoroughly inspected before being returned to service.

- All manufactured and end fittings and connections must be installed according to the manufacturer's specifications.

- Swivel bearings on ball-bearing type hoisting swivels must be inspected and lubricated daily to ensure that the swivel rotates freely under load.

- Do not drill through or rotate drill through a slipping device, do not hoist more that 10 feet of the drill rod column above the top of the last (mast), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool hoists while the rod column is being supported by a rod slipping device.

- Do not attempt to brake the fall of a drill rod column with your hands or by increasing tension on the rod slipping device.

- Wire ropes must be properly matched with each sheave. The sheave will pinch wire rope that is too large. Wire rope that is too small will groove the sheave. Once a sheave is grooved, it will severely pinch and damage larger sized wire rope.

- Use tool handling hoists only for vertical lifting of tools. Do not use tool handling hoists to pull on objects away from the drill rig.

- All hoisting hooks will be equipped with safety latches.

- When tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull for the hoist line or the feed mechanism of the drill.

- Minimize shock loading of a wire rope; apply loads smoothly and steadily.

- Avoid sudden loading in cold weather.

- Never use frozen ropes.

- Protect wire rope from sharp corners or edges.

- Replace faulty guides and rollers.

- Replace worn sheaves or worn sheave bearings.

- Know the safe working load of the equipment and tackle. Never exceed safe working limits.

- Periodically inspect clutches and brakes of hoists.

- Always wear gloves when handling wire ropes.

- Do not guide wire rope onto hoist drums with your hands.

- After installation of a new wire rope, the first lift must be a light load to allow the wire rope to adjust.

- Never leave a load suspended when the hoist is unattended.

- Never use a hoist line to ride up the mast.

Cathead and Rope Hoist Safety

- Keep the cathead clean and free of rust and oil and/or grease. The cathead must be cleaned with a wire brush when it becomes rusty.

- Check the cathead for rope wear grooves. If a rope groove forms that is deeper that ⅛ inch, the cathead must be replaced.

- Always start work with a clean, dry, sound rope. A wet or oily rope may grab the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast. If the rope grabs the cathead or otherwise becomes tangled in the drum, release the rope and sound the alarm for all personnel to clear the area rapidly.

- The rope must not be permitted to contact chemicals.

- Never wrap the rope from a cathead around a hand, wrist, arm, foot, ankle, leg, or any other body part.

- Attach the hammer to the rope using a knot that will not slip such as a bowline.

- A minimum of 18 inches must be maintained between the operating hand and the cathead drum when driving samplers, casing, or other tools. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground. Loosen grip on the rope as the hammer falls. Maintaining a tight grip on the rope increases the chances of being pulled into the cathead.

- Do not use a rope that is longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.

- Do not leave a cathead unattended with the rope wrapped on the drum.

- Position all other hoist lines to prevent contact with the operating cathead rope.

- The cathead operator must be on a level surface with good, firm footing conditions.

Auger Safety

- The drill rig must be level, the clutch or hydraulic rotation control disengaged, the transmission in low gear and the engine running at low RPM when starting an auger boring.

- Seat the auger head below the ground surface with an adequate amount of downward pressure prior to rotation.

- Observe the auger head while slowly engaging the clutch or rotation control and start rotation. Stay clear of the auger.

- Slowly rotate the auger and auger head while continuing to apply downward pressure. Keep one hand on the clutch or the rotation control at all times until the auger has penetrated about one foot or more below the surface.

- Follow manufacturer's recommended methods for securing the auger to the power coupling.

- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.

- Never place feet under the auger section that is being hoisted.

- Stay clear of rotating augers and other rotating components of the drill rig.

- Never reach behind or around a rotating auger.

- Use a long-handle shovel to move auger cuttings away from the auger.

- Augers will be cleaned only when the drill rig is in neutral and the augers have stopped rotating.

Rotary and Core Drilling Safety

- Water swivels and hoist plugs must be lubricated and checked for frozen bearings before use.

- Drill rod chuck jaws must be checked periodically and replaced as necessary.
- The weight of the drill rod string and other expected hoist loads must not exceed the hoist and sheaves capacities.
- Only the operator of the drill rig will brake or set a manual chuck to ensure that rotation of the chuck will not occur prior to removing the wrench from the chuck.
- The drill rod chuck jaws will not be used to brake drill rods during lowering into the hole.
- Drill rods will not be held or lowered into the hole with pipe wrenches.
- Do not attempt to grab falling drill rods with hands or wrenches.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction must be relieved or bled down prior to breaking the first tool joint.
- Use a rubber or other suitable rod wiper to clean rods during removal from the hole. Do not use hands to clean drilling fluids from the drill rods.
- Do not lean unsecured drill rods against the mast.

Attachment C

Health and Safety Plan Forms

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site and returned to: EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: CTO — 106

Contract No: N62467-89-D-0318

Project: SWMU 14 — Former Building S-140 Site and Seventh Avenue Ditch

I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

____

Signed

____

Print Name

____

Company

____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: ______________________________

Job Name: ______________________________

Date(s) From/To: ______________________________

Hours On Site: ______________________________

Contaminants (Suspected/Reported):

____

____

____

____

____

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____

____

____

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____

____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)

NAME OF INJURED OR ILL WORKER AND COMPANY

WORKER'S SOCIAL SECURITY NUMBER

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐	LOST WORK DAY WITH _____DAYS AWAY FROM WORK	LOST WORK DAY WITH _____DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY ☐ FIRST-AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR (Print)	TITLE
	DATE

Attachment D

Directions to Emergency Medical Facilities

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

The nearest hospital **and** the nearest facility capable of treating chemical burns are the same facility, which is located at Methodist North Hospital. Therefore, there is only one set of directions.

Nearest Hospital

Methodist North Hospital
3960 Covington Pike
Memphis, Tennessee

Emergency Room Telephone Number — (901) 372-5211

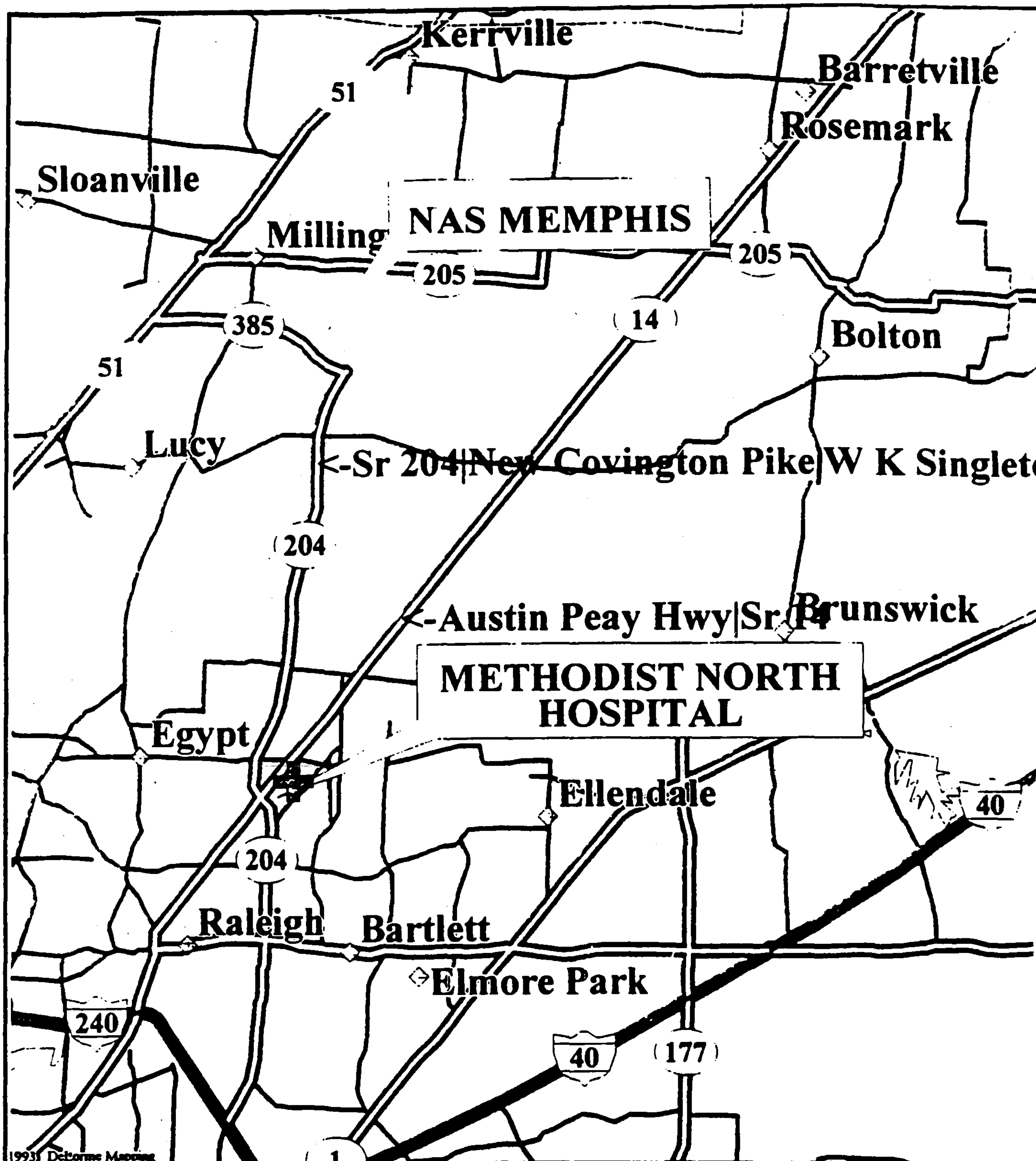
Directions to Methodist North Hospital from NAS Memphis Main Gate:

1) Exit site through South Gate (Singleton Parkway).

2) Continue on Singleton Parkway through the stop signs.

3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).

4) You will see the entrance to the emergency room 700 feet past this light on the left.



HEALTH & SAFETY PLAN
NAS MEMPHIS
MILLINGTON, TN

DIRECTIONS TO THE HOSPITAL

DWG DATE: 10/04/94 | DWG NAME: BOARD

ASSEMBLY E — RFI WORK PLAN
NAVAL AIR STATION MEMPHIS

SITE INVESTIGATION PLAN
SWMU 14
FORMER SITE OF BUILDING S-140 AND
SEVENTH AVENUE DITCH

CTO-106
Contract No. N62467-89-D-0318

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

Prepared by:

EnSafe/Allen & Hoshall
5720 Summer Trees Drive, Suite 8
Memphis, Tennessee 38134
(901) 383-9115

September 20, 1995

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1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long Term Environmental Action Navy Program, the following RCRA Facility Investigation (RFI) Site Investigation Plan (SIP) has been prepared for SWMU 14, the former site of Building S-140 and the Seventh Avenue ditch, at NAS Memphis, Millington, Tennessee. The primary reference for this plan is the *Comprehensive RFI Work Plan* (E/A&H, 1994).

2.0 ENVIRONMENTAL SETTING

SWMU 14 is a flat, grass-covered area on the Southside of NAS Memphis, east of Seventh Avenue and north of Polaris Drive (Figure 1). Drainage ditches are located to the south and west of the site. The eastern portion of the site has a small stand of pine trees, several sidewalks, and a large open field that was once used as a trailer park. Residential property is at the far east end of this open field.

Building S-140, demolished in 1985, contained a paint spray booth, a paint removing area, and a paint wash-down area used to train Navy personnel in painting-related processes from 1943 to 1985. According to engineering plans of the building obtained from Public Works, four smaller structures also were associated with the building. Building 275, function unknown, was approximately 50 feet east of S-140 and was demolished in 1985. Building S-1602 was reportedly a mobile building along the eastern edge of the site and was removed from the site in August 1989. Building 351, 50 feet southeast of S-140, reportedly was a pre-fabricated metal storage building used as a paint locker prior to its demolition in 1985. The 1990 RFA description for SWMU 14 (ERC Environmental and Energy Services Co., 1990) is provided in Attachment 1 of this document.

Also associated with Building S-140 is SWMU 46, a former hazardous waste accumulation point that was at the north end of a paved area east of the building. In 1980, the site was used for less-than-90-day storage of drummed hazardous waste. Waste paints and thinners were

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Figure 1 Vicinity Map

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reportedly stored at SWMU 46. This SWMU will be investigated during the Assembly G Confirmatory Sampling Investigation.

2.1 Topography and Drainage

The site is relatively flat with no obvious direction for surface-water runoff. It is likely, however, that all runoff currently discharges as sheet flow to the Seventh Avenue ditch to the west and a smaller ditch to the south. These ditches, which ultimately discharge into the Big Creek Drainage Canal, are partially concrete-lined. According to base drainage maps, a storm drain was located in an outdoor wash basin south of Building S-140. The drain connected to a 12-inch concrete line which ran beneath the southern access road and discharged directly into the southern ditch. The drain line was plugged in 1980 and drainage diverted to the sanitary sewer. Today, there is no evidence of the drain, but the associated outfall still is present in the bank of the ditch. A topographic map showing the local land surface elevations for SWMU 14 is provided in Attachment 2 of this document.

2.2 Geologic and Hydrogeologic Information

The regional and local hydrogeology are described in Sections 2.11 and 2.12 of the *Comprehensive RFI Work Plan*. Site-specific geologic and hydrogeologic information has been collected from the following sources:

- Several stratigraphic test borings completed on the NAS Memphis Southside, including two test holes recently completed by the United States Geological Survey (USGS).

- Subsurface information generated during the installation of two background well clusters, designated BG-02 and BG-04, on the Southside.

The following sections describe the geologic and hydrogeologic information for NAS Southside.

2.2.1 Stratigraphic Test Borings

Stratigraphic Test Hole SH:U-89, approximately 4,500 feet northeast of SWMU 14, was drilled and logged in 1983 in preparation of installing Southside production well PW-5 in 1985. The U. S. Geologic Survey (USGS) recently completed two soil borings on the Southside, designated as Test Holes 7 and 8 (Figure 1). Test Hole 7 is approximately 75 feet north of SWMU 14 and Test Hole 8 is approximately 3,500 feet south-southwest of SWMU 14 at the southern corner of the sewage lagoons (SWMU 9) near the Big Creek Drainage Canal. The following table describes the lithology encountered in each stratigraphic test hole.

Table 1
Stratigraphic Test Borings on the NAS Memphis Southside

Stratigraphic Unit	SH:U-89[a,b]	Test Hole 7 (SH:V-79)	Test Hole 8 (SH:V-80)
Alluvium	Not present	Not present	Clayey silt 0-35 feet bls[c], sand and gravel 35-45 feet bls (45')[d]
Loess	Silt and clay deposits 0 to 38 feet bls (38')	Silt and clayey silt 0 to 34 feet bls (34')	Not present
Fluvial Deposits	Sand and gravel 38 to 97 feet bls (59')	Sand, gravel, and silt 34 feet bls to 47 feet bls (13')	Not present
Cockfield Formation	Sand, silt, clay, and lignite 97 feet bls to 134 feet bls (37')	Sand, silt, clay, and lignite from 47 feet bls to 173 feet bls (126')	Sand, silty sand, clay, and lignite 45 to 153 feet bls (108')
Cook Mountain Formation	Hard clay and silt from 134 feet bls to 160 feet bls (26'); confining unit for the Memphis Aquifer	Hard slightly silty clay from 173 feet bls to termination depth of boring at 202 feet; confining unit for the Memphis Aquifer	Hard slightly silty clay from 153 feet bls to termination depth of boring at 182 feet bls; confining unit for the Memphis Aquifer

Notes:

[a] SH:U-89 - USGS well designations
[b] Lithologic description for U-89 based on driller's log contained in Attachment 3. Lithologic descriptions for Test Holes 7 and 8 based on oral communication with USGS representatives; geophysical logs are forthcoming in USGS publications.
[c] bls - below land surface
[d] (38') - indicates thickness of formation

As shown on Table 1, lithology in the upper interval of the test borings differs from north to south and west to east. Instead of loess and fluvial deposits, alluvium is present in the stratigraphic test boring nearest to Big Creek (Test Hole 8). In addition, when comparing Test Hole SH:U-89 to Test Holes 7 and 8, the fluvial deposits are thinner and the Cockfield

Formation thicker in the eastern part of the Southside. A copy of the boring log for SH:U-89 is included in Attachment 3 of this document.

The USGS collected soil samples from USGS Test Holes 7 and 8 and submitted them for geotechnical analyses (J. Carmichael, USGS, written communication, 1995). Table 2 presents the hydraulic conductivity results of the soil samples.

Table 2
Hydraulic Conductivity Analyses: USGS Test Holes 7 and 8

Test Hole	Sample Depth (feet bls[a])	Hydraulic Conductivity[b]
TH-7	10 - 12	2.83×10^{-7}
TH-7	160 - 162	1.04×10^{-7}
TH-7	200 - 201.5	3.48×10^{-7}
TH-8	17 - 19.5	2.41×10^{-6}
TH-8	180 - 182.5	1.76×10^{-9}

Notes:

[a] bls denotes below land surface
[b] Hydraulic conductivity determined using the following method: triaxial, constant head, undisturbed method; data reported in centimeters per second. Results obtained through written communication with Mr. Jack Carmichael of USGS.

2.2.2 Background Well Clusters Number 2 and 4

Two background well clusters, designated BG-02 and BG-04, were installed on the Southside in January, 1995, in conjunction with the RFIs at Assembly A SWMUs. Figure 1 shows the background well locations and Attachment 3 of this document contains the boring logs. The following table describes the lithology encountered at each background well location.

The lithology encountered at background well locations BG-02 and BG-04 was similar to that of stratigraphic test hole SH:U-89 and Test Hole 7 described above; however, the fluvial deposits at BG-02 were thicker (38 feet) than at Test Hole 7 (13 feet).

Table 3
Background Wells on the NAS Memphis Southside

Stratigraphic Unit	BG-02	BG-04
Alluvium	Not present	Not present
Loess	Silt and clay deposits 0 to 29 feet bls (29')	Silt and clayey silt 0 to 38 feet bls[a] (38')[b]
Fluvial Deposits	Sand and gravel 29 to 77 feet bls (48')	Sand, gravel, and silt 38 feet bls to 71 feet bls (33')
Cockfield Formation	Sand, silt, and clay 77 feet bls to termination depth of the boring at 87 feet bls	Sand and clay from 71 feet bls to termination depth of the boring at 76 feet bls

Notes:

[a] bls = below land surface
[b] (29') - indicates thickness of formation

2.2.3 Shallow Groundwater

No groundwater monitoring wells exist at SWMU 14. Based on existing regional information and conversations with USGS personnel, depth to groundwater is expected to range between approximately 10 and 15 feet below land surface (bls). Based on topography and the information contained in the conceptual model of the NAS Memphis hydrogeology (Section 2.12 of the *Comprehensive RFI Work Plan*), groundwater is presumed to flow in a southwesterly direction in the fluvial deposits/deeper alluvium in the vicinity of SWMU 14. Within the NAS Memphis Southside, groundwater in the loess/shallow alluvium most likely moves primarily downward to recharge the fluvial deposits/deeper alluvium. In the immediate vicinity of SWMU 14, some water in the loess/alluvium may move laterally to discharge to the ditches west and south of the site.

2.3 Climatological Data

Regional climatological data are provided in Section 2.8 of the *Comprehensive RFI Work Plan.*

3.0 SOURCE CHARACTERIZATION

The *Initial Assessment Survey* (NEESA, 1983) included a hazardous-waste survey, which indicated that acidic paint strippers, ethyl acetate, isopropyl alcohol, methyl ethyl ketone, PD-680, waste paint, other paint strippers, and spray booth sludges were used or generated in Building S-140. According to building diagrams, there were two drainage systems associated with painting activities at S-140, one in the central portion of the building which housed the paint spray booths and water wash pits and one in the northern portion where the interior wash-down area and work table were located.

Paint-related wastes generated by the paint spray booth and water wash pits in the central portion of the building were apparently collected in two floor drains which emptied into two large sump pits. Paint waste and sludge from these sumps most likely were removed on an as-needed basis, with any overflow discharged directly to the Seventh Avenue ditch. This waste and sludge contained chromium, lead, and various hydrocarbons and paint solvents including mineral spirits, toluene, and phenols. After 1980, the flow from the paint booth and wash-down area was redirected to a paint separator/sump in the building's mechanical room with the overflow going to the sanitary sewer.

Wastes generated by the paint wash-down area and work tables in the northern portion of the building were discharged to an unidentified drain line exiting the east side of the building. In 1968, these wastes were diverted to an interceptor/separator installed beneath the north end of a sidewalk immediately east of the building. According to construction diagrams, this interceptor was 3.5 x 5 feet across with the deepest portion of the bottom 4.5 feet bls. Discharge from the interceptor was directed to the sanitary sewer line to the north.

Another potential source of contaminants at SWMU 14 was an outdoor wash basin at the southern portion of the site that since has been removed. This 36 x 40-foot concrete slab was surrounded by a 6-inch berm and, according to sewer modification diagrams, the drain in this basin once discharged to the southern drainage ditch, but was diverted to the sanitary sewer in 1980.

A visual inspection of the site by E/A&H on June 8, 1995, found no evidence of the building, sumps, paint separator, or discharge line to the Seventh Avenue ditch. Only the small outfall leading from the former wash basin at the southern part of the former facility was identified in the southern drainage ditch.

4.0 CHARACTERIZATION OF HAZARDOUS CONSTITUENT RELEASES

4.1 Previous Investigations

This area has not been previously studied.

4.2 Data Gaps

Data gaps include information pertaining to the potential for sediment, subsurface soil, and groundwater contamination. Addressing the following data gaps will be the focus of this investigation:

- The status and/or impact of the sumps, paint separator, and discharge line.
- The potential for sediment contamination in nearby ditches.
- The potential for surface-soil contamination.
- The potential for subsurface soil contamination in the loess.
- The potential for groundwater contamination in the loess and fluvial deposits.

4.3 Objective and Proposed Field Investigation

The objective of the proposed field investigation is to fill the data gaps listed in Section 4.2 and to delineate the horizontal and vertical extent of any soil, sediment, and/or groundwater contamination present at SWMU 14. The field sampling investigation will consist of a preliminary geophysics investigation and two subsequent primary phases in which soil, groundwater, and sediment samples will be collected as outlined below.

The first phase will consist of collecting soil and groundwater samples using Direct Push Technology (DPT) equipment, and collecting sediment samples from the drainage ditches on the south and west sides of the site. After the BRAC Cleanup Team (BCT) reviews the analytical data from the DPT phase of this investigation, a second phase will be conducted. The second phase will consist of conducting and sampling soil borings and installing and sampling monitoring wells. All sample collection and processing will be in accordance with Section 4 of the *Comprehensive RFI Work Plan*.

Contaminant concentrations identified in soil and groundwater at SWMU 14 will be compared to background soil and water concentration data from four existing monitoring well clusters, two of which (BG-02 and BG-04) were installed on NAS Southside (Figure 1) and two on NAS Northside. At a fifth background location on the Northside, a soil boring was completed and sampled, but monitoring wells were not installed due to the lack of groundwater in the loess and the unexpected thinness of the fluvial deposits at that location. Contaminant concentrations identified in sediment at SWMU 14 will be compared to upgradient sediment concentrations from the SWMU 38 (Miscellaneous Ditches in the Industrial Areas) secondary drainage ditches on the Southside. These comparisons will assist in determining whether measured values occur naturally or indicate contamination. Samples of these mediums also will be compared to the appropriate action levels to determine if further investigation and remediation are necessary.

Reference materials will be used to determine the physical, chemical, and migration/dispersal characteristics of any contaminants identified during the RFI that exceed the appropriate action levels. The procedures and references used to determine these characteristics will be documented in the RFI report. Each phase of the proposed investigation is outlined in the following sections.

4.3.1 Geophysical Survey

On July 19, 1995, E/A&H performed a geophysical survey at SWMU 14 in an attempt to verify the approximate location of the former building and subsurface structures. The geophysical data were generated using frequency-domain electromagnetic instrumentation (EM-31). The EM-31 survey included a conductivity survey and an in-phase (metal detection) survey. Geophysical anomalies due to disturbed soil or metal objects were plotted on a map, and proposed sample locations were chosen after reviewing the results. The geophysical survey identified one moderate anomaly at SWMU 14 near the former location of an outdoor washbasin. The rest of the surveyed area was anomaly-free, indicating the sumps and separators may have been removed during building demolition. A linear feature along the site's eastern survey boundary may be an abandoned potable water line that supplied water to the adjacent property when it was a trailer park. Attachment 5 of this document provides the *Geophysical Survey Report* (E/A&H, 1995) for SWMU 14.

4.3.2 DPT Investigation

The first phase of soil and groundwater sampling will be conducted using DPT equipment, with sampling and field analyses conducted in accordance with the methodology outlined in Section 4.4.4.3 of the *Comprehensive RFI Work Plan*. Results of the DPT investigation will be used to plan the placement of monitoring wells in the second phase of the investigation.

Prior to collecting soil and groundwater samples, the DPT *piezocone system*, which consists of an electronic cone penetrometer, will be used to obtain lithologic information and identify potential water-bearing zones. The piezocone obtains and plots measurements of point-stress, sleeve friction, and pore pressure as the tool is advanced into subsurface. As shown on Figure 2, four DPT *piezocone* locations are proposed around the area of investigation.

As shown on Figure 2, 11 DPT sampling locations are proposed. Five of the sampling locations will be positioned surrounding the former waste receiving structures near the northeast corner

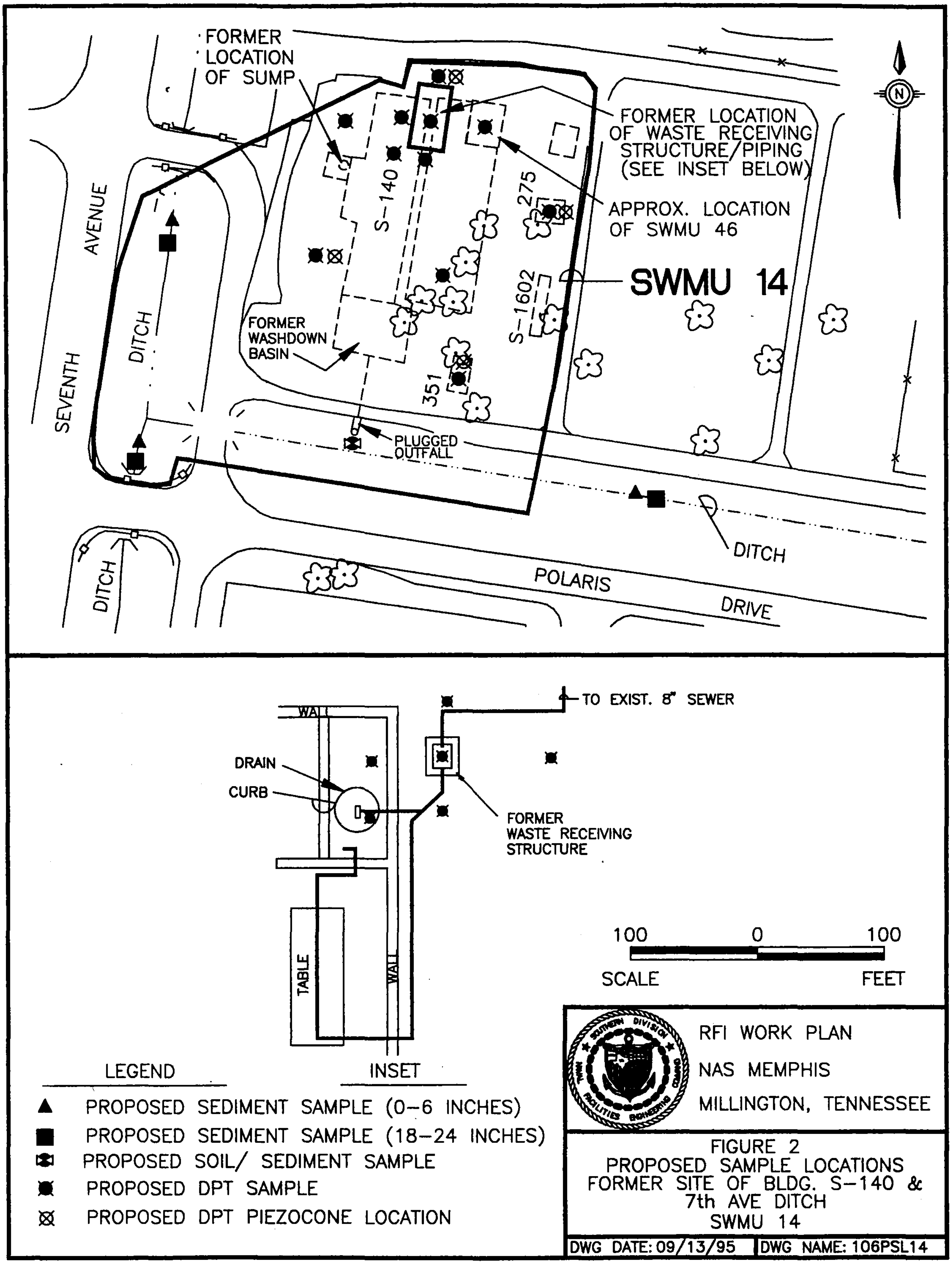

FIGURE 2
PROPOSED SAMPLE LOCATIONS
FORMER SITE OF BLDG. S-140 &
7th AVE DITCH
SWMU 14

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of the building. One sampling location also will be positioned in the center of SWMU 46 (former hazardous waste accumulation point), Building 351 (former paint locker in the southeast corner of the site), and Building 275 (function unknown). Two DPT sampling locations also are proposed to assess migration between Building S-140 and the Seventh Avenue ditch. One unbiased sampling location will be positioned east of the former building's southern portion. These sampling locations were selected to: (1) estimate the nature and extent of contamination (if any) and (2) provide a geologic cross-section of the loess and upper fluvial deposits in the area.

It is anticipated that the DPT equipment will be able to penetrate only to the top of the fluvial deposits; therefore, data from the DPT investigation will be limited to a depth of approximately 40 feet bls. Results of the DPT investigation will be used to plan the numbers, locations, and depths of soil borings and monitoring wells in the second phase of the investigation.

Volatile organic compounds (VOC) analysis of both soil and groundwater samples will be performed in a field laboratory using a gas chromatograph (GC), with at least 25% of the collected samples split and sent to an offsite laboratory for confirmatory purposes. Split samples submitted to the offsite laboratory will be analyzed for VOCs using USEPA Method 8240. Split-sample selection will be determined in the field.

Soil

Figure 2 shows the 11 proposed DPT soil and groundwater sampling locations. The DPT geocone sampler, which is a split-spoon sampler with a push plug on the leading end, will be advanced and retracted to retrieve relatively undisturbed subsurface soil samples from the following intervals at each sample station:

- From just above the soil-water interface (anticipated to be between 10 and 15 feet bls).
- From an intermediate interval between the surface and the first water encountered (approximately 5 to 7 feet bls).

Different and/or additional intervals also may be sampled if piezocone logs or other field observations suggest that a change in sampling strategy would yield useful results. Any deviations from the proposed strategy or locations will be recorded in the field logbook along with an explanation for each deviation. If contamination is identified at a subsurface soil-sampling location through field screening or laboratory analysis, additional sampling locations will be selected to estimate the extent of contamination.

Groundwater

The DPT equipment will be used to collect groundwater samples from the water-bearing zones at each sample station. If possible, two water samples will be collected from each sampling location as follows:

- The top of the first saturated zone encountered.
- Refusal (presumed to be just below the top of the fluvial deposits).

Field personnel may deviate from this strategy if field conditions or data (i.e., piezocone or screening analysis) suggest that additional or different sampling intervals may be successfully sampled or would yield more useful information. The area(s) under investigation then may be enlarged or reduced and additional sampling locations may be selected based on the results of the data from the initial DPT sampling. Any deviations to the sampling plan will be recorded in the field logbook along with an explanation for each deviation.

4.3.3 Sediment and Shallow Soil Samples

Sediment samples will be collected from three locations within the adjacent drainage ditches (Figure 2) to determine if SWMU 14 contaminants have been transported either by direct discharge or surface runoff. At each of the three locations, a sediment sample will be collected from the following intervals:

- 0 to 6 inches bls (to capture recent deposition).
- 18 to 24 inches bls (to capture contaminants from past releases).

In addition to the three sediment sampling locations in the adjacent drainage ditches, one shallow soil sample station is proposed at a location just below the cement spillway at the small outfall which leads from SWMU 14 to the cement-lined ditch along Polaris Drive. Shallow soil samples will be collected using a hand auger from the following intervals:

- 0 to 6 inch bls.
- 18 to 24 inches.

All sediment and shallow soil samples will be collected in accordance with Section 4.7 of the *Comprehensive RFI Work Plan* and submitted for Full-Scan Analysis (FSA) using the following methods:

Analysis	*Method*
Volatile Organic Compounds	USEPA Method 8240
Semivolatile Organic Compounds	USEPA Method 8270
Total Petroleum Hydrocarbons - Gasoline and Diesel-Range Organics	TN Modified 8015 - GRO.BTEX/DRO
Chlorinated Pesticides/PCBs	USEPA Method 8080
Organophosphorus Pesticides	USEPA Method 8140
Chlorinated Herbicides	USEPA Method 8150
40 CFR Pt. 264, Appendix IX Metals	USEPA Method 6010/7000 series
Total Cyanide	USEPA Method 9010

For comparison, sediment samples also will be collected from both upgradient and downgradient locations of the drainage ditches during the SWMU 38 RFI (refer to Figure 2, Proposed Sample

Locations, in the SWMU 38 RFI Work Plan in this document). Field personnel may deviate from this sampling strategy should field conditions or data suggest that changing the sampling location, interval, or frequency would yield more useful results. Any deviations will be recorded in the field logbook along with an explanation for each deviation.

4.3.4 Soil and Groundwater Investigation

The numbers, locations, and depths of soil borings and monitoring wells will be determined using data from the first phase of this investigation. Soil borings will be advanced and sampled and monitoring wells will be installed using the Rotasonic drilling technique as described in Section 4.4.5 of the *Comprehensive RFI Work Plan*. All soil and groundwater samples collected during this phase of the investigation will be analyzed for FSA using the methods listed in Section 4.3.3 above.

Approximately 6 soil borings, each converted to a groundwater monitoring well, will be advanced and sampled during the second phase of the RFI. The monitoring wells will be installed in three paired clusters (one shallow and one deeper). Each cluster will consist of one monitoring well screened in the first water-bearing zone in the loess (anticipated to be less than 20 feet bls) and one screened in the upper fluvial deposits (anticipated to be 35 to 45 feet bls). The soil boring/monitoring well locations will be selected based on the DPT investigation.

Soil Borings

Soil borings will be advanced and sampled prior to monitoring-well installation. The three shallow soil borings will be advanced and continuously sampled to a depth of approximately 20 feet in the loess. The three deeper borings will be advanced into the upper fluvial deposits (anticipated to be between 35 and 45 feet bls). All borings will be continuously sampled for lithologic description and organic vapor field screening, with information recorded in the field logbook. Samples for laboratory analysis will be collected at three intervals from one boring at each well pair location. Subsurface soil samples will be collected from the following intervals:

- Near-surface (1 to 2 feet bls).
- From just above the soil-water interface (anticipated to be between 10 and 15 feet bls).
- From an intermediate interval between the surface and the first water encountered.

The intermediate subsurface soil sample interval will be selected based on organic vapor readings or by field judgement as described in Section 4.4.4 of the *Comprehensive RFI Work Plan*. All soil samples collected during this second phase will be submitted for FSA.

Monitoring Wells

Three monitoring well clusters will be installed during the second phase of investigation. Each cluster will consist of one monitoring well installed in the loess to a depth of between 10 and 20 feet bls and one monitoring well in the fluvial deposits to a depth of approximately 35 to 45 feet bls. The proposed well locations and depths, determined from the DPT investigation, will be submitted as an addendum to this plan. The monitoring wells will be constructed of 2-inch PVC with 10-foot screens. The wells will be installed in accordance with Section 4.5 of the *Comprehensive RFI Work Plan*, using Rotasonic drilling techniques. Groundwater samples will be collected as described in Section 4.6 of the *Comprehensive RFI Work Plan*. All groundwater samples collected from the monitoring wells will be submitted for FSA.

To further define the lithology of the site, the deepest monitoring well drilled at the site will be logged geophysically as described in Section 4.3.3.4 of the *Comprehensive RFI Work Plan*. The logging data will be correlated to data obtained from USGS Stratigraphic Test Holes 7 and 8 for use in determining local lithology.

Field personnel may deviate from the proposed sampling strategy should data from the DPT investigation, field conditions, or organic vapor field screening readings suggest that additional or different intervals may be successfully sampled or yield more useful information. Deviations will be documented in the field logbook and the RFI Report. The area of investigation then may be expanded or concentrated, based on the results of the initial data.

Design Parameters

Soil and groundwater samples will be collected and analyzed for engineering design parameters to plan for soil and/or groundwater remediation, in accordance with Section 4.4.5 of the *Comprehensive RFI Work Plan*. One soil sample will be collected from above the first zone of saturation and will be analyzed for total phosphorus, nitrate-N, total Kjeldahl nitrogen, heterotrophic plate count, total organic carbon, and cation exchange capacity. One Shelby-tube sample will be collected from each lithologic unit (Section 4.4.5 of the *Comprehensive RFI Work Plan*) and analyzed for hydraulic conductivity, porosity, bulk density, particle size, percent moisture, and specific gravity.

One groundwater sample also will be collected from each screened water-bearing zone (loess and upper fluvial deposits) and analyzed for the following parameters to obtain data for potential remedial design: 5-day biochemical oxygen demand, chemical oxygen demand, hardness, total suspended solids, total dissolved solids, alkalinity, total phosphorus, nitrate-N, total Kjeldahl nitrogen, sulfates, heterotrophic plate count, turbidity, iron, and manganese.

Hydrologic Characterization

If groundwater contamination is present at SWMU 14 and remediation is required, aquifer tests (pump test, specific capacity test, and/or slug tests) will be performed at select monitoring wells to determine the aquifer response and to characterize subsurface hydrologic conditions (i.e., hydraulic conductivity, transmissivity, storativity). Aquifer tests are described in Section 4.9.4 of the *Comprehensive RFI Work Plan*.

4.3.5 Expansion of Investigation

If laboratory data indicate the presence of soil, sediment, or groundwater contamination in the proposed sample locations, additional sampling locations may be required to fully define the nature and extent of contamination, particularly in the determined downgradient groundwater flow direction.

Measured contaminant concentrations in soil and groundwater, coupled with groundwater-flow directions and characteristics, will be used to determine the locations of additional soil borings and/or monitoring wells, if the investigation is expanded. The soil and groundwater investigation will proceed until the nature and extent of contamination have been adequately defined and/or risk assessment modeling results indicate that downgradient concentrations are below action levels at potential receptor sites.

4.4 Analytical Requirements

Soil, sediment, and groundwater samples will be collected from SWMU 14 for laboratory analysis. Sampling and analytical requirements are summarized in Table 4.

Soil and groundwater samples collected during the DPT survey will be analyzed in the field with a portable GC at Level II-equivalent Data Quality Objectives (DQO). For those samples submitted for offsite laboratory analysis, Level III-equivalent DQO will be used for 95% of the samples and Level IV for the remaining 5%.

Table 4
Proposed Sampling and Analytical Requirements — SWMU 14

Method	Sample Matrix/Type	Number of Samples	Analysis
DPT	Physical	4 Piezocone	—
	Soil	22	VOCs
	Groundwater	22	VOCs
Hand Auger	Soil	1 (0 - 6")	FSA
		1 (18 - 24")	FSA
Hand Auger or Trowel	Sediment	3 (0 - 6")	FSA
		3 (18 - 24")	FSA

Table 4
Proposed Sampling and Analytical Requirements — SWMU 14

Method	Sample Matrix/Type	Number of Samples	Analysis
Boring	Soil	9	FSA
		2	DPS
		2	ST
Monitoring Well	Groundwater	3 Loess	FSA
		3 Fluvial	FSA
		2 (1 Loess, 1 Fluvial)	DPW

Notes:

FSA (Full Scan Analysis) = GRO-TPH; DRO -TPH; VOCs; SVOCs; chlorinated pesticides/PCBs, organophosphorus pesticides, chlorinated herbicides; total metals (Appendix IX), and cyanide.

DPS (Design Parameters Soil) = Total phosphorus, nitrate-N, total Kjeldahl nitrogen (TKN), heterotrophic plate count, total organic carbon (TOC), cation-exchange capacity.

ST (Shelby Tube) = Hydraulic conductivity, porosity, bulk density, particle size, percent moisture, and specific gravity.

DPW (Design Parameters Water) = five-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), hardness, total suspended solids (TSS), total dissolved solids (TDS), alkalinity, total phosphorus, nitrate-N, TKN, heterotrophic plate count, turbidity, iron and manganese.

A detailed list of the analytical parameters shown in Table 4 is provided in Appendix F of the *Comprehensive RFI Work Plan.* Field sampling personnel will determine which samples will be analyzed for Level IV-equivalent DQO. Field measurements at SWMU 14 will be collected in accordance with Section 4.10.1 of the *Comprehensive RFI Work Plan.* Measurements will include organic vapor for soil samples and boreholes; and pH, temperature, specific conductivity, and groundwater level for monitoring wells.

4.5 Sample and Data Management

Sample and data management procedures will adhere to Sections 4.12 and 5.0 of the *Comprehensive RFI Work Plan.*

4.6 Sample Custody

Sample custody will adhere to Section 4.12.5 of the *Comprehensive RFI Work Plan.*

4.7 Quality Assurance/Quality Control

Quality assurance/quality control procedures to be followed during the investigation will adhere to Section 4.14 of the *Comprehensive RFI Work Plan*.

4.8 Decontamination Procedures

Decontamination procedures will adhere to Section 4.11 of the *Comprehensive RFI Work Plan*.

4.9 Investigation-Derived Waste

Investigation-derived waste will be handled as specified in Section 4.13 of the *Comprehensive RFI Work Plan*. E/A&H is currently preparing a detailed *Investigation-Derived Waste Management Plan* for NAS Memphis. This plan, which will be submitted prior to the Assembly E field activities, provides additional guidance for handling IDW generated during the Assembly E RFI.

5.0 POTENTIAL RECEPTORS

SWMU 14 is located approximately 4,000 feet west of the nearest offsite residence and 200 feet west of the nearest NAS Memphis personnel. The SWMU is approximately 800 feet west of the base daycare center. The ditches draining the SWMU lead through populated areas of the base; therefore, the potential exists for contact with surface water and sediment in these features by base personnel. The stormwater from the site ultimately discharges into the Big Creek Drainage Canal, from which animals drink and feed. According to base personnel, no fishing or swimming occurs in the Big Creek Drainage Canal, but children may play near it.

Other potential receptors include two production wells (PW-4 and PW-5). PW-4 is approximately 5,800 feet northwest of SWMU 14 and PW-5 is approximately 4,100 feet northwest. Both production wells are screened in the Fort Pillow Aquifer (PW-4 is screened at a depth of 1,450 feet bls and PW-5 is screened at a depth of 1,435 feet bls), with the Flour Island confining unit above the screened intervals. The potential for ecological and human health effects will be analyzed in more detail and presented in the RFI report is contamination is found at SWMU 14.

6.0 QUALITY ASSURANCE PLAN

The Quality Assurance Plan presented in Section 4.14 of the *Comprehensive RFI Work Plan* will be followed throughout the RFI at SWMU 14.

7.0 DATA MANAGEMENT PLAN

The Data Management Plan presented in Section 5.0 of the *Comprehensive RFI Work Plan* will be followed during the RFI for SWMU 14.

8.0 HEALTH AND SAFETY PLAN

The site-specific Health and Safety Plan for SWMU 14 is included in Appendix A of this document. The Comprehensive Health and Safety Plan is included in Section 7 of the *Comprehensive RFI Work Plan*.

9.0 REFERENCES

EnSafe/Allen & Hoshall (October 1994). *Comprehensive RFI Work Plan for Naval Air Station Memphis*. E/A&H: Memphis, Tennessee.

EnSafe/Allen & Hoshall (1995). *Final Groundwater Monitoring Well Management Plan, Phase I, Naval Air Station Memphis*. Revision 1, E/A&H: Memphis, Tennessee.

EnSafe/Allen & Hoshall (September 1995). *Geophysical Survey Report — SWMUs 14, 36, and 65, Naval Air Station Memphis*. E/A&H: Memphis, Tennessee.

ERC/EDGe (September 1990). *RCRA Facility Assessment (RFA), NAS Memphis*. ERC/EDGe: Nashville, Tennessee.

Southern Division Naval Facilities Engineering Command (May 1990). *Draft Final RCRA Facility Investigation Work Plan for Naval Air Station-Memphis*. SOUTHDIV: Charleston, South Carolina.

United States Geological Survey (1995). Oral and written communication with Mr. Jack Carmichael. USGS: Nashville, Tennessee.

Appendix A

Site-Specific Health and Safety Plan

Attachment 5

Geophysical Survey Report - SWMUs 14, 36, and 65

GEOPHYSICAL SURVEY REPORT
NAVAL AIR STATION
MEMPHIS, TENNESSEE

SWMU's 14, 36, and 65

CTO-094

Prepared For:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

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Memphis, Tennessee 38134
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September 15, 1995

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EXECUTIVE SUMMARY

In support of environmental investigations at Naval Air Station (NAS) Memphis, EnSafe/Allen & Hoshall conducted geophysical surveys at Solid Waste Management Units (SWMUs) 14, 36, and 65 to identify building foundations, characterize the extent of buried material, and map features of potential environmental concern.

The anomalies were classified according to the likelihood that they might be of environmental concern: Type A anomalies are well-defined features needing further investigations, Type B are weaker anomalies, Type C are anomalies not related to buried features.

One moderate Type B anomaly was identified at SWMU 14 near the former location of an outdoor washbasin. The rest of the surveyed area was anomaly-free.

Four tightly grouped Type A anomalies were identified at SWMU 36 in the previous area of Incinerator 4 and its underground storage tank (UST). UST identification, however, is uncertain due anomaly overlap caused by the tight grouping, and the absence of a northing direction on the site engineering plans.

Geophysics data for SWMU 65 show one Type A anomaly in the former location of two USTs that fueled the engine test cell S-346. Two zones of culture were identified onsite, with the rest being anomaly-free.

Follow-up investigations may be needed at Type A sites to ascertain whether the anomalies are due to innocuous, minor buried rubble, such as metal debris, or if they represent a genuine environmental concern. The geophysics data indicate very specific locations to conduct follow-up investigations.

INTRODUCTION

EnSafe/Allen & Hoshall (E/A&H) recently performed geophysical surveys at Naval Air Station (NAS) Memphis, in Millington Tennessee, to characterize subsurface conditions within three Solid Waste Management Units (SWMUs). Survey results will be used to evaluate site environmental conditions, and identify potential areas for subsequent invasive environmental investigations.

The investigations used the frequency domain electromagnetics (FDEM) technique to detect buried metals and disturbed soil. FDEM provides rapid and high-density data coverage of conductive features within approximately 6 meters of the surface.

FIELD IMPLEMENTATION

To ensure accurate and reliable data collection, and reproduction of anomaly source locations, orthogonal reference grids were used over each investigation area. The grid interval for each SWMU depended on project goals and the expected anomaly magnitudes from source bodies onsite. Baselines were marked first using a compass and back sighting from a fixed position on the grid. The fixed position for each grid was referenced as 1000N/1000E. Wood stakes were placed every 10 feet along key east-west grid lines. Data were collected along north-south lines by careful pacing, using the wood stakes to maintain the correct east-west alignment. Conductivity and in-phase data were obtained using a vertical dipole configuration at an elevation of 1 meter above ground surface (using the shoulder sling supplied with the instrument).

GEOPHYSICAL APPLICATION

Description of FDEM

FDEM is a geophysical technique useful for mapping buried drums, tanks, utility lines, old trenches, construction rubble, extent of landfills, etc. Typically the instrument is an EM-31, manufactured by Geonics, Ltd. The EM-31 consists of a 2-meter long boom with a transmitting antenna at one end and a receiving antenna at the other. The transmitting antenna is energized by a current pulse, which propagates into the ground as an electromagnetic field. As it encounters electrically responsive materials in the ground, the signal received at the surface in the receiving antenna is distorted. These distortions can then be interpreted to develop a graphical image of the subsurface.

The signal can penetrate to 6 meters below ground surface. FDEM is primarily a profiling method that does not yield detailed vertical resolution, although it can perform some limited sounding capability by varying the instrument height and dipole orientation. Resolution in plan view is often to within a meter or so. Signals are sensed by the instrument's electronics and the data are sent to a field data recorder, whose contents are downloaded to a second computer for processing and plotting.

Two parameters are measured: conductivity and in-phase. Conductivity is a measurement of how well the earth conducts electrical current. Dry materials yield low conductivities, while wet materials yield high conductivities. Saturated clays are particularly conductive. When present, buried metals may also increase the effective conductivity. Conductivity data have units of milliSiemens per meter (mS/m).

The in-phase component is a ratio of the secondary to primary field strengths (the primary field is the generated signal and the secondary is the ground's response). The in-phase component is primarily sensitive to metals, not soil moisture, and can go negative or positive over metallic objects, depending on the relative geometries of the conductor and instrument. In-phase has units of parts per thousand (ppt) of the secondary field strength.

FDEM was used on this project to detect disturbed soil and buried metals related to excavation activities, and to find potential underground storage tanks (USTs).

QUALITY ASSURANCE PROCEDURES

Equipment was calibrated according to the manufacturer's instructions every morning prior to data acquisition.

Two items of chief concern in any dataset are precision and biasing; Both can influence the interpretability of a dataset. A standard set of tests was used to investigate both types of effects. Results are outlined below.

Data Precision

A base station is normally established in a background area to determine short-term and long-term measurement precision. Periodically during data acquisition, the instrument is returned to the base station and 10 to 20 successive bursts are measured. At NAS Memphis, one base station was used for each SWMU: SWMU 14 (800N/1100E), SWMU 36 (940N/970E), and SWMU 65 (1030N/1200E).

Short-term precision shows how closely a measurement can be repeated in a short range of time, and thus is a function of inherent instrument noise. Short-term precision is estimated by a statistical analysis of the base station burst measurements. The results are as follows:

RESULTS	Conductivity (mS/m)	In-Phase (ppt)
Short-Term Precision SWMU 14	±.0672	±.0095
Short-Term Precision SWMU 36	±.0209	±.0091
Short-Term Precision SWMU 65	±.1478	±.0237
BENCHMARKS		
Desired Minimum Resolution	±1.	±0.5
Subtle Foundation Anomaly	±2.	±1.
Typical Buried Drum Anomaly	±5.	±5.

The precision is acceptable, judged by benchmarks set by the survey objectives, and hence does not influence the interpretability of the three datasets. The precision level is better than average for EM-31 surveys at the three base stations used in this investigation.

Long-term precision is primarily controlled by instrument drift, which occurs because of slight response changes in the instrument's electronics. Figure 1 shows the instrument drift recorded while occupying the three individual base stations. The minimum and maximum vertical scales are adjusted to represent ±10% of the conductivity value and ±1 ppt of in-phase, considered to be "high drift" bounds which, when exceeded, suggest that drift corrections may need to be considered. The drift is smaller than usual for EM-31 measurements and does not exceed the desired minimum resolution benchmarks defined previously. No correction is required for the magnitude of drift observed at the three individual sites.

Data Biasing Effects

Spatial aliasing is an undersampling effect when searching for small, subtle targets, such as deeply buried single drums. The key to a successful survey is to optimize the grid spacing or data density to the smallest target being investigated. In this case, a single sump pump is the smallest object sought. Experience has shown that a 10- by 10 foot grid is a good compromise between effectiveness of detection and survey speed for objects the size of drums or pumps. Most objects of this size within the penetration range of the instrument will be detected in a 10- by 10-foot data grid.

Instrument response time/nonreciprocity effects can occur on large-scale surveys, when the instrument is advanced at a rapid rate along prescribed lines, which reverse direction on each line. This procedure produces a wavy pattern at the edges of high-amplitude anomalies due to a finite instrument response time and due to nonreciprocity when the receiver and transmitter antennas reverse positions. Effects of this nature do not compromise data quality or interpretability.

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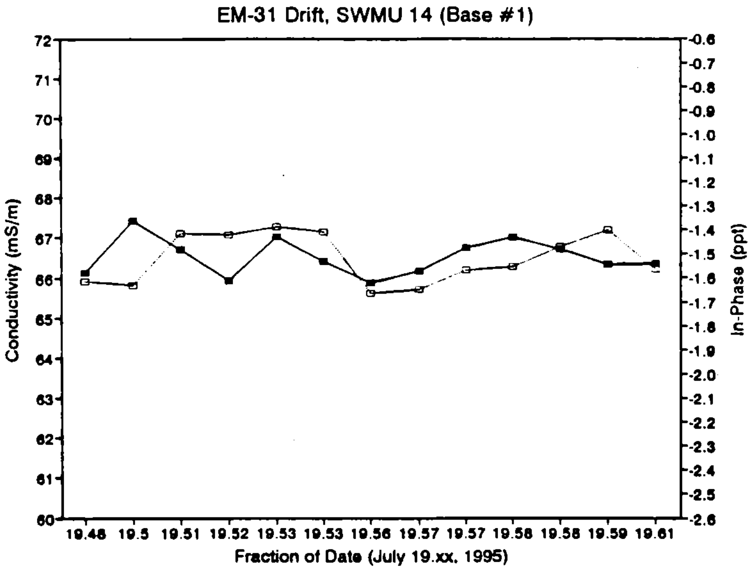
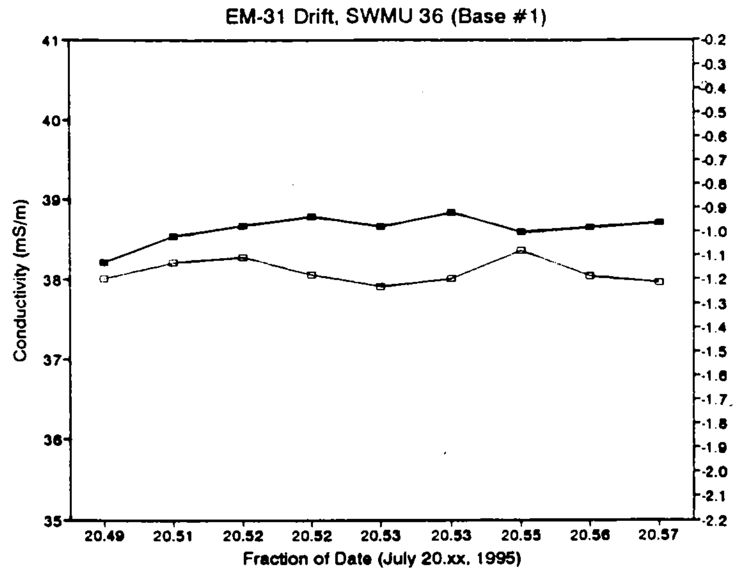
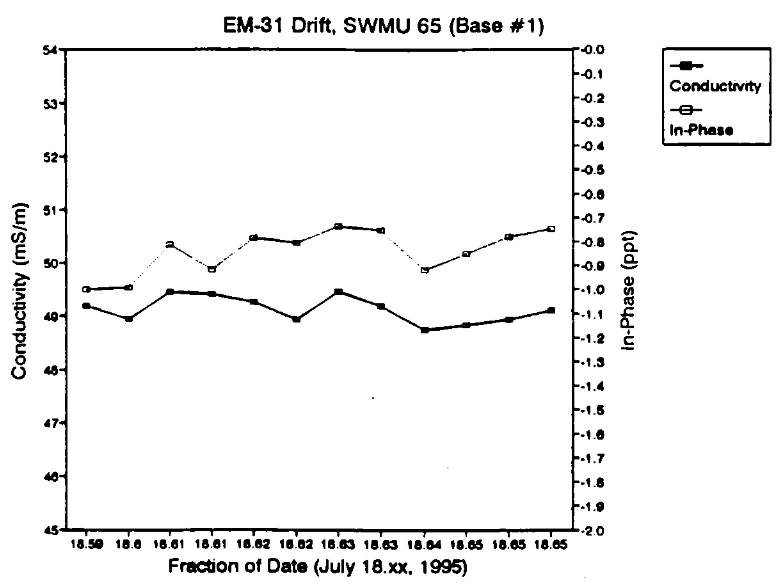

EM-31 Drift, SWMU 14 (Base #1)
Conductivity (mS/m)
In-Phase (ppt)
Fraction of Date (July 19.xx, 1995)


EM-31 Drift, SWMU 36 (Base #1)
Conductivity (mS/m)
Fraction of Date (July 20.xx, 1995)


EM-31 Drift, SWMU 65 (Base #1)
Conductivity (mS/m)
In-Phase (ppt)
Fraction of Date (July 18.xx, 1995)
Conductivity
In-Phase

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GENERAL NOTES ON DATA INTERPRETATION

Each investigation created plan-view maps taken from conductivity and in-phase datasets. Site features are superimposed to aid the interpretation.

The conductivity maps reveal soil moisture changes in each SWMU. The data are depicted in color according to the color bar on the right side of each map. Both large and small conductivity values (compared to background) may be significant, although they do not necessarily indicate separate features but may be edge effects from a single feature. Extremely large and small values, sometimes with a distinct linear appearance, are often associated with fences and underground utilities. Other anomalies not related to culture are observed, ranging from broad changes over several hundred feet to very small, isolated ones.

The in-phase data maps can roughly be thought of as a metal indicator. The nominal response in a metal-free area should be nearly zero. Large positive and negative values generally indicate the presence of metal features associated with buried objects, or aboveground culture such as fences, road signs, buildings, etc. As with conductivity data, in-phase data clearly indicate buried utilities, and also show numerous small, scattered anomalies.

The anomalies identified at the three sites are classified according to their interpretated significance with respect to the individual project objectives:

- Type A — Strong, well-defined anomaly characteristic of a buried object, for which some follow-up (site walkover, soil boring, trench, etc.) is recommended.

- Type B — Weaker or more poorly defined anomaly due to a buried object, but less likely to be of environmental concern. Follow-up is deemed less critical, but depends on the investigations of Type A anomalies.

- TYPE C — Anomaly not believed to be caused by buried material of environmental concern. Examples are anomalies from ditches, culture, metal objects at the surface, etc. Follow-up is not recommended.

- TYPE D — Anomaly-free in light of the stated objectives.

A table provided for each SWMU describes the anomalies and recommendations for follow-up. If a follow-up investigation is done, the best spots for doing so are indicated for Type A anomalies in the second column on each table. Note that follow-up will first be a site walkover to determine if the anomaly is due to some nonenvironmental object, such as buried construction debris or topography. The bulk of these explanations were eliminated during the geophysics work, but a second site walkover is still recommended. Invasive work may be planned based upon the site walkover.

SWMU 14

Setting and Regional Geology

SWMU 14 is on the south side of NAS Memphis, adjacent to Seventh Avenue and the east end of D Street. This SWMU was once the site of Building S-140, which housed a paint spray booth, a paint removing area, and a paint washdown area used by Navy personnel from 1943 to 1985. Also onsite were several smaller temporary structures, primarily storage areas for equipment and chemical supplies. The site has generally flat terrain with well-defined drainage ditches to the south and west. The surface is mostly grassy and weedy, with occasional areas of bare soil or stress grass. The eastern portion of the site has a small stand of pine trees, several sidewalks, and a large open field once used as a trailer park. Scattered across the SWMU are several cement footings and light cement rubble.

Field Procedures

A 10-foot grid interval for SWMU 14 was used as a compromise for sampling potentially large footprint sources (i.e., building foundations), along with smaller sources such as sump pumps and drainage lines. Key east-west cross lines staked every 100 feet were marked with high-visibility paint. Data were obtained walking north on even-numbered lines and south on odd-numbered lines. The receiver antenna was pointed north on even lines and south on odd lines. Grid corners for the site are 1000N/1000E and 700N/1260E. Fieldwork for this site was completed in one session (July 19).

Data Interpretation

Figures 2 and 3 show the plan-view maps, consisting of conductivity and in-phase field data, respectively. Both sets of data show broad-band regional effects which characterize the inherent background conductivity levels of the subsurface. The data collection method introduced minor nonreciprocity effects along the southern boundary of the field data. The wavy pattern is the result of reversing the antenna orientation on north and south data traverses. The continuity of data, across known culture onsite, would suggest the entire dataset is valid.

Anomaly Description

Table 1 lists the anomalies identified at SWMU 14. Most anomalies at SWMU 14 are near-surface, localized features most likely unrelated to the target source bodies outlined in the site investigation plan (i.e., sumps, paint separator, and discharge line) (Figure 4). Only one area was classified anomalous, a type B, based on its spatial map position to the previous outdoor washbasin south of S-140. A possible source for this anomaly may be demolition rubble used to fill the depression left by basin excavation. Otherwise, the absence of discernible anomalies would suggest that sumps and separators may have been removed during demolition. The discharge line may be undetectable if non-ferrous materials were used in its construction. Engineering plans for this site indicate the discharge line may have been

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Figure 2 Conductivity Map of SWMU 14.

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Figure 3 In-Phase Map of SWMU 14.

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Figure 4 Geophysical Interpretation for SWMU 14.

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made of plastic, which would make it undetectable using FDEM. Type C anomalies, attributed to surface and subsurface culture, are quite prevalent here; the most noticeable example is the linear feature along the eastern survey boundary. The source for this anomaly may be an abandoned water line that supplied potable water to the adjacent property when it was a trailer park. The large magnitude response of the water line is due to a coupling effect along the north-south traverses. Culture has the potential of masking meaningful anomalies; however, at this site, the culture is distant enough not to interfere with site interpretation. Approximately three-quarters of the surveyed area is anomaly-free (Type D). The remainder was left undesignated due to cultural interference or because the data show subtle changes which could indicate some limited soil disturbance.

Table 1
SWMU 14 Anomaly Interpretations

No.	Best Position to Investigate	Notes
B1	1140E/810N	Moderate anomaly; metal indicated. Anomaly may be associated with washdown basin at S-140 site.
B2	—	Strong anomaly; metal indicated. Single station anomaly.
C1	—	Buried utilities; possibly water main.
C2	—	Surface culture; road sign.
C3	—	Surface culture; cement footing with metal cover.
C4	—	Buried utility; sewer main.
D1	—	Zone cleared of anomalies.

SWMU 36

Setting and Regional Geology

SWMU 36, the former location of Incinerator 4, is on the north side of NAS Memphis off from Dakar Street Extended near the base's northwestern perimeter. Since the incinerator's demolition in 1984, the lack of site activity has allowed the area to be overgrown with dense vegetation.

During its operation, 1943 through 1984, the incinerator burned classified material, including nonhazardous paper and plastic identification cards. The incinerator was housed in a split-level structure constructed of wood and cement bricks. The incinerator was in the lower level which extended 7 feet below grade. Adjacent to the building was a 1,100 gallon fuel UST, that supplied the incinerator equipment. The tank was installed 2 feet below grade to facilitate gravity feed to the incinerator.

SWMU 36 has generally flat terrain excluding the artificial mound left by the incinerator's demolition. The front half of the site is generally clear of heavy brush and mainly consists of scrub weeds and grasses. The back half is covered by new growth saplings, which extend back approximately 20 to 30 feet to old growth. Terrain in the new growth is generally uneven with numerous shallow depressions. In the northwestern section of the new growth is a mound, approximately 3 feet high and 4 to 5 feet long. Scattered along the margin of the new growth are several cement and asphalt piles. Rebar, presumably part of the foundation, is also exposed at the surface at several locations. During the survey, rebar and asphalt piles were observed in close proximity and most frequently within and along the new growth forest line. The cement piles tended to occur along the periphery of the SWMU site, encircling the asphalt and rebar piles.

Field Procedures

Data collection on SWMU 36 used a grid interval of 5 feet with every grid node marked with either a wood stake or high-visibility paint. All data were collected walking north with the receiver antenna pointed north. Data were acquired over two days, mostly the first day (July 20). On the second day (July 21), acquisition efforts pushed deeper into the woods to characterize anomalous features identified the previous day. Grid corners for the site are 1040N/945E and 920N/1000E.

Data Interpretation

Figures 5 and 6 show plan-view maps of conductivity and in-phase field data, respectively. Most of the recorded response at this site could be characterized as nominal. Large anomalous responses occur in a localized area near surface piles of rebar and asphalt. Engineering plans place the incinerator and its fuel cell in the general area of the large anomalous responses. The proximity of these large anomalous features, both positive and negative, complicate delineating responses to a specific source body.

Anomaly Description

Table 2 lists the anomalies identified at SWMU 36. Anomalies cover a small percentage of the survey area, but a large percentage are classified Type A (Figure 7). Of the five anomalies identified, four are classified Type A and attributed to buried conductive material. The fifth anomaly is classified Type B, which usually requires no follow-up work. However, in some cases of clustered, strong anomalies, one anomaly relegated to Type B does not eliminate it from further invasive examination; it merely implies that Type A anomalies should be evaluated first. A Type C anomaly, attributed to a sewer line, is identified trending east-west across the northern portion of site. The rest of the site was anomaly-free (Type D). Culture at SWMU 36 did not hinder data interpretation.

Table 2
SWMU 36 Anomaly Interpretations

No.	Best Position to Investigate	Notes
A1	985E/990N	Strong anomalous zone; buried metals indicated. Demolition debris observed at surface this may due to same, but the strength and size of the anomaly suggests further investigation.
A2	985E/1005N	Strong anomaly; buried metals indicated. Rebar and demolition debris observed in area. Strength of anomaly suggests further investigation

Table 2
SWMU 36 Anomaly Interpretations

No.	Best Position to Investigate	Notes
A3	990E/976N	Strong anomaly; buried metals indicated. Rebar and demolition debris observed in area. Strength of anomaly suggests further investigation.
A4	1015E/995N	Moderate anomaly; buried metal indicated. Little demolition debris in area, possible source for anomaly may be buried UST. A high priority for follow-up.
B1	—	Moderate anomaly; well-defined zone of soil moisture and weak metal content. Source may be water or sewer line.
C1	—	Buried utilities; sewer main.
D1	—	Zone cleared of anomalies.

SWMU 65

Setting and Regional Geology

The third geophysics survey was conducted at SWMU 65 on the southside of NAS Memphis, adjacent to the south gate entrance. The Navy formerly used this site as a training area for turbo-jet engine start-up. The area consists of 15 parking stubs for training aircraft and a jet engine test cell (Building S-346). The geophysics survey focused on the area immediately north of Building S-346, which formerly had two USTs to fuel the test cell. This portion of SWMU 65 is an open area with gently rolling terrain and a drainage depression that extends the entire eastern boundary of the investigation area. The surface is mostly grassy and weedy with several zones of stressed grass. Access points for subsurface utilities were observed just north of the investigation area parallel to the eastern site boundary.

Figure 5 Conductivity Map of SWMU 36.

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Figure 6 In-Phase Map of SWMU 36.

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Figure 7 Geophysical Interpretation for SWMU 36.

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Field Procedures

Data collection on SWMU 65 used a 10-by 10-foot grid extending from 1200N/1000E to 1000N/1080E. Data were acquired in one session (July 18) walking north with the receiver antenna orientated north. High-visibility paint marked each grid node.

Data Interpretation

Figures 8 and 9 show the conductivity and in-phase field maps, respectively. The geophysics indicate most of the surveyed area responded in the nominal range. Several areas show evidence of strong anomalous activity with steep response gradients. It is unlikely that indigenous materials would produce gradients as large as those indicated in the field data. A probable source for such high gradient responses could be buried utilities. Minimal response time/nonreciprocity effects are observed in the dataset.

Anomaly Description

Table 3 lists the anomalies identified at SWMU 65. Only one significant anomaly was identified a Type A north of the Building S-346 (Figure 10). The source of this anomaly may be attributed to buried metal associated with the fuel system that supplied the engine test cell. A strong, localized anomaly, designated Type B, was identified along the southeastern boundary of the surveyed area. A source for this response is undetermined. The site also has two Type C anomalies which did not adversely affect data interpretation. Approximately one-fourth of the surveyed area is anomaly-free (Type D).

CONCLUSIONS

The geophysical surveys performed at NAS Memphis sufficiently defined the surveyed areas to state the following conclusions. SWMU 14 is generally free of anomalous activity associated to target source bodies outlined in the site investigation plan. Based on approximate source locations taken from the site plans, the geophysics for SWMU 14 do not suggest the presence of either a building foundation, sump pump, or paint separator. The absence of the discharge

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Figure 8 Conductivity Map of SWMU 65.

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Figure 9 In-Phase Map of SWMU 65.

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Figure 10 Geophysical Interpretation for SWMU 65.

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Table 3
SWMU 65 Anomaly Interpretations

No.	Best Position to Investigate	Notes
A1	1020E/1050N	Strong anomaly; buried metal indicated. Probable remnants of USTs. High priority for follow-up.
B1	—	Moderate anomaly; buried metal indicated. Anomaly unrelated to survey objectives.
C1	—	Buried utilities; possibly water main serving S-346.
C2	—	Surface metal associated with Building S-346.
D1	—	Zone cleared of anomalies.
D2	—	Zone cleared of anomalies.

line, in both the conductivity and in-phase datasets, is most likely due to the line's resistor qualities, rather than line excavation.

The survey results from SWMU 36 indicate anomalous features are clustered in a pattern consistent with the dimensions of Incinerator 4. UST identification is complicated due do the lack of a northing direction on the site engineering plans, and the high amplitude response from the source bodies onsite. One possible geophysical interpretation, based on site engineering plans and survey data, places a UST in the area of anomalous zone A4.

The geophysics performed at SWMU 65 may have identified the previous location of USTs that fueled the engine test cell S-346. Site plans for this SWMU indicated the fuel tanks were buried north of Building S-346; an anomalous response, attributed to buried metal, was recorded north of S-346, in the approximate area indicated for the USTs.

A site walkover, possibly followed by invasive investigation, is recommended for Type A anomalies.

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ASSEMBLY E — RFI WORK PLAN
NAVAL AIR STATION MEMPHIS

SITE-SPECIFIC HEALTH AND SAFETY PLAN
SWMU 14
FORMER BUILDING S-140 SITE and
SEVENTH AVENUE DITCH

CTO-106
Contract No. N62467-89-D-0318

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
North Charleston, South Carolina

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September 20, 1995

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1.0 INTRODUCTION

As part of the U.S. Navy Comprehensive Long Term Environmental Action Navy (CLEAN) program, the following Site Specific Health and Safety Plan (SSHSP) has been prepared for the RCRA Facility Investigation (RFI) at SWMU 14, the Former Building S-140 Site and Seventh Avenue Ditch, at the Naval Air Station (NAS) Memphis, Millington, Tennessee.

This plan is to be used in conjunction with the approved NAS Memphis Comprehensive Health and Safety Plan (CHASP). Copies of both this plan and the CHASP should be onsite during all field operations. The Navy project contract number with EnSafe/Allen & Hoshall (E/A&H) is N62467-89-D-0318, CTO-106.

Applicability

See CHASP Section 7.0.

Current Hazardous Waste Operators and Emergency Response (HAZWOPER) training certificates for E/A&H, E/A&H subcontractors, and USGS personnel anticipated to be conducting field work onsite, will be filed in the field trailer and available for review. Individuals whose certifications are not on file, or those who have a more recent certificate (have attended a refresher course), will provide the Onsite Supervisor with a copy of their certificate before being allowed to enter a work area.

Current OSHA refresher training certificates will be available, in the field trailer, for all employees involved in field activities if their refresher course requirements come up for renewal before the project begins. All subcontractors, DOD oversight personnel, and any other site visitors must provide health and safety certification with appropriate refresher course documentation prior to site entry.

2.0 SITE CHARACTERIZATION

2.1 Site Description

SWMU 14 is a flat, grass-covered area on the Southside of NAS Memphis, east of Seventh Avenue and north of Polaris Drive. Drainage ditches are located to the south and west of the site. The eastern portion of the site has a small stand of pine trees, several sidewalks, and a large open field that was once used as a trailer park. Residential property is at the far east end of this open field.

Building S-140, demolished in 1985, contained a paint spray booth, a paint removing area, and a paint wash-down area used to train Navy personnel in painting-related processes from 1943 to 1985. According to engineering plans of the building obtained from Public Works, four smaller structures also were associated with the building. Building 275, function unknown, was approximately 50 feet east of S-140 and was demolished in 1985. Building S-1602 was reportedly a mobile building along the eastern edge of the site and was removed from the site in August 1989. Building 351, 50 feet southeast of S-140, reportedly was a pre-fabricated metal storage building used as a paint locker prior to its demolition in 1985.

Also associated with Building S-140 is SWMU 46, a former hazardous waste accumulation point that was at the north end of a paved area east of the building. In 1980, the site was used for less-than-90-day storage of drummed hazardous waste. Waste paints and thinners were reportedly stored at SWMU 46. This SWMU will be investigated during the Assembly G Confirmatory Sampling Investigation.

2.2 Work Areas

See Section 7.1.1 of the CHASP for a description of the following work zones:

- Exclusion Zone (EZ),
- Contaminant Reduction Zone (CRZ), and
- Support Zone (SZ).

For a description of field activities to be conducted at the site and within each work area see the Site Investigation Plan (SIP).

2.3 Work Area Access

Authorized personnel will be allowed access to work areas as long as they follow the requirements of this SSHSP and the CHASP. See also Work Area Access, Section 7.1.2 of the CHASP.

2.4 Site Map and Work Zones

The location of the site is shown in Figure 1, the vicinity map. A site map of SWMU 14 with proposed sampling locations is shown in Figure 2. The EZ, CRZ, and SZ locations will be based on physical layout of the site, work task requirements, and current meteorological conditions. Figure 3 provides a typical example of how work zones will be established at a site.

3.0 SITE ACTIVITIES

Site activities will include soil sampling (via hand auger), soil borings, and groundwater monitoring well installations. Subsequent activities will include well development, purging, and sampling as required. Field work is described in the Comprehensive RFI Work Plan.

4.0 CHEMICAL HAZARDS

Previous sampling operations and site history show a potential for exposure to various chemical contaminants. Table 4-1 lists exposure guidelines for potential site chemicals.

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Figure 1 Vicinity Map

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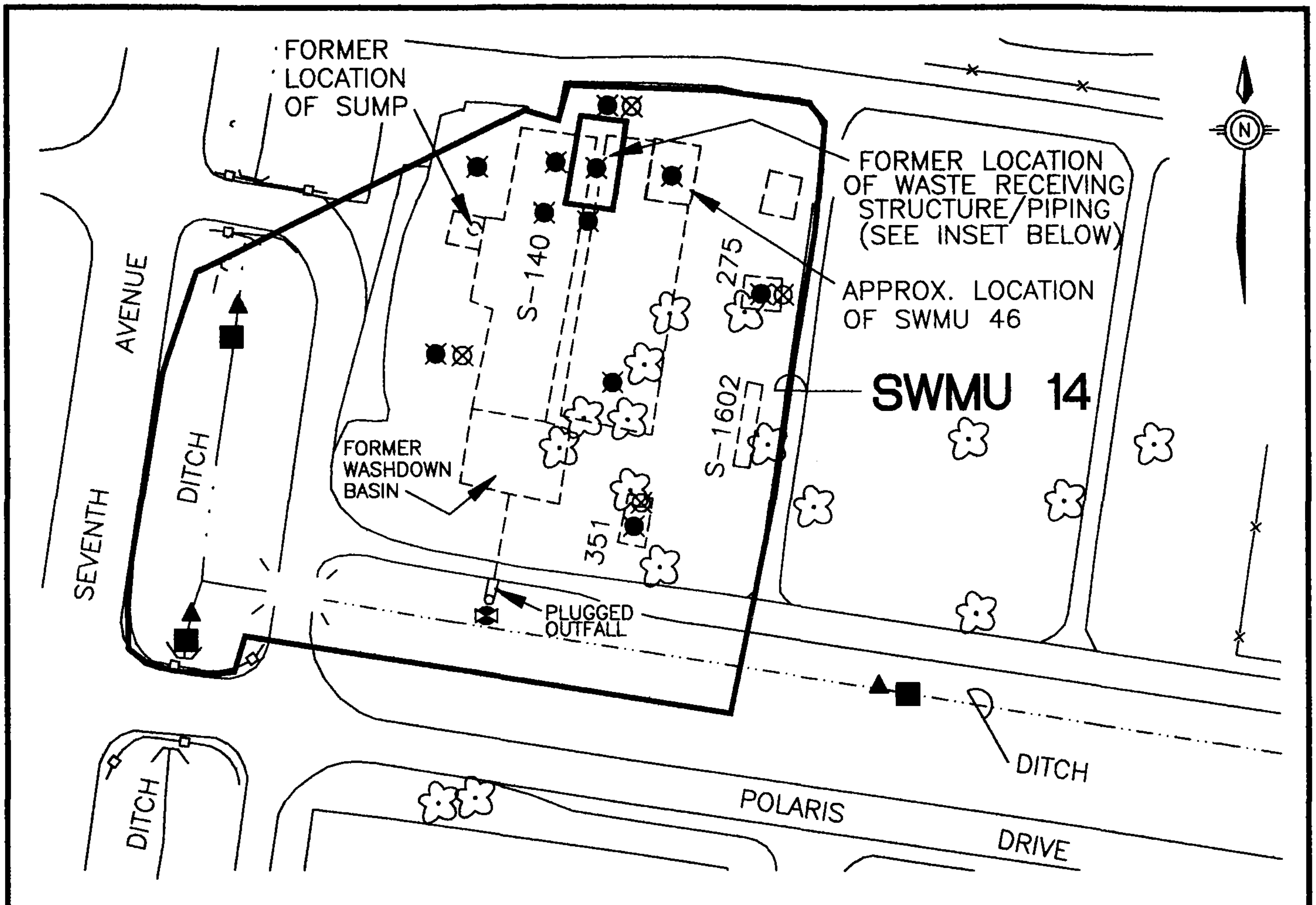

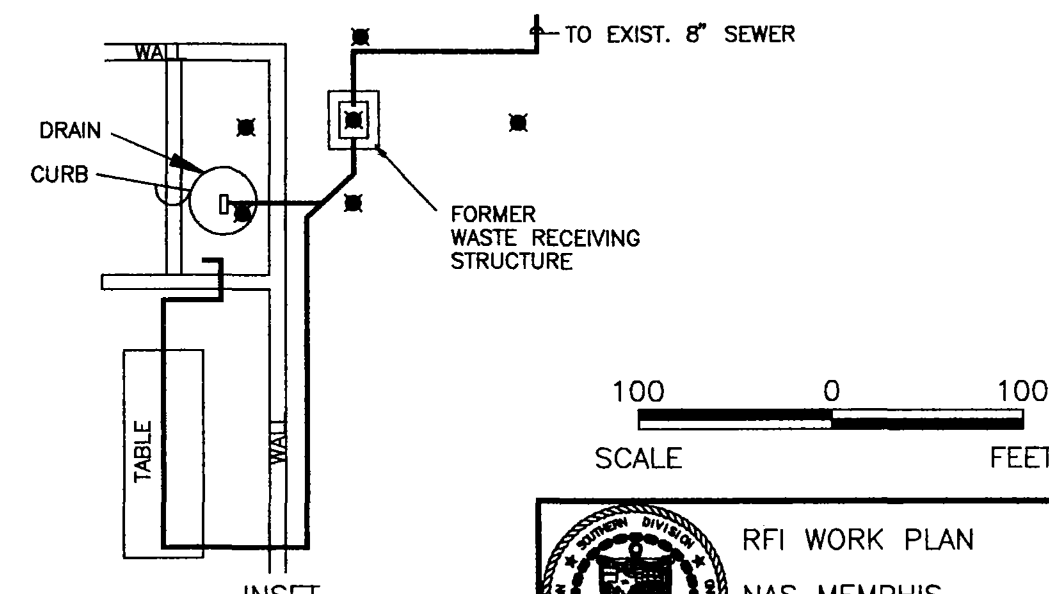

INSET

LEGEND

- ▲ PROPOSED SEDIMENT SAMPLE (0–6 INCHES)
- ■ PROPOSED SEDIMENT SAMPLE (18–24 INCHES)
- PROPOSED SOIL/ SEDIMENT SAMPLE
- ● PROPOSED DPT SAMPLE
- ⊠ PROPOSED DPT PIEZOCONE LOCATION

RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TENNESSEE

FIGURE 2
PROPOSED SAMPLE LOCATIONS
FORMER SITE OF BLDG. S–140 &
7th AVE DITCH
SWMU 14

DWG DATE: 09/13/95	DWG NAME: 106PSL14

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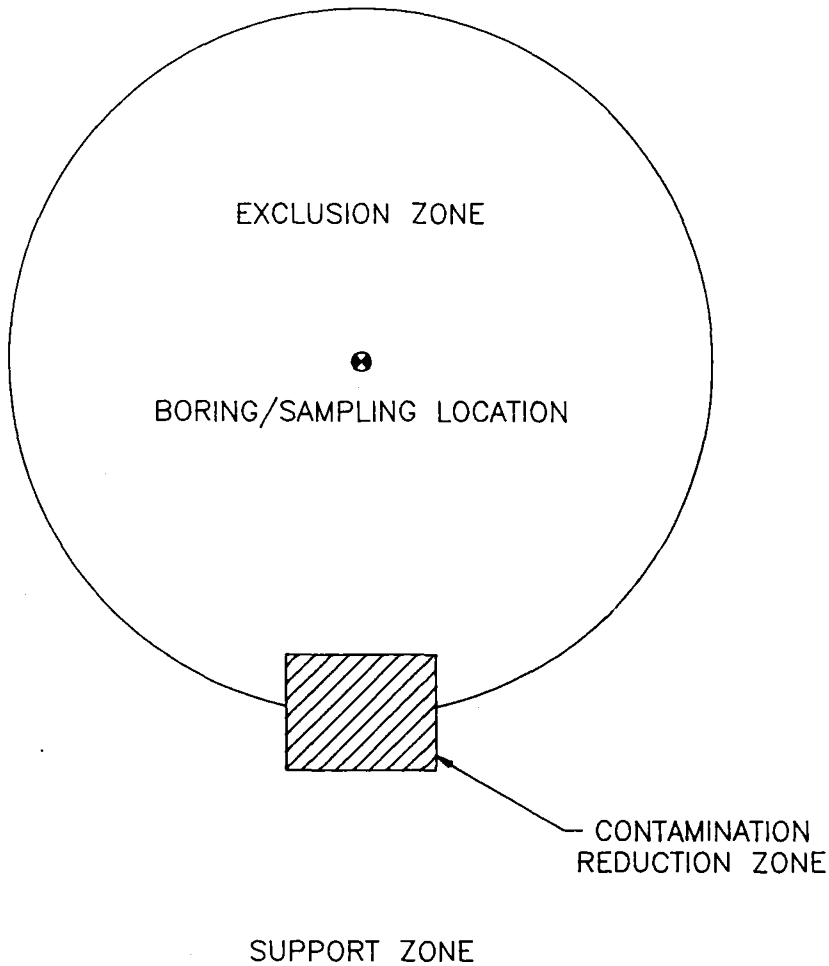

NOT TO SCALE

RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TN

FIGURE 3
SITE WORK ZONES

DWG DATE: 09/12/95 | DWG NAME: 094SWZ01

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Table 4-1
Exposure Guidelines For Expected Site Chemical Hazards

Chemical Name	Odor[a] Threshold (ppm)	OSHA PEL[b] (ppm)	ACGIH TLV[c] (ppm)	NIOSH REL[d] (ppm)	Action Level[e] (ppm)	Flammable Range (% by Volume)
Toluene	40	100 150 STEL	50	100 150 STEL	25	1.3 to 7.1%
Acetone	100	1000	750 1000 STEL	250	125	2.5 to 12.8%
Mineral Spirits	1	500	100	350	50	2.5 to 18%
Methylene Chloride	214	500 1000 STEL	50	Lowest Feasible Concentration	25	12 to 19%
Ethyl Acetate	1	400	400	Not Listed	200	2.2 to 11%
Isopropyl Alcohol	36	400 500 STEL	400 500 STEL	400 800 Ceiling	200	2.3 to 12.7%
Methyl Ethyl Ketone	10	200 300 STEL	200 300 STEL	200	100	1.8 to 11.5%
Acetone	100	750 1000 STEL	750 1000 STEL	250	125	2.6 to 12.8%
Lead	N.A.	50 $\mu g/m^3$	0.15 mg/m^3	0.1 mg/m^3	25 $\mu g/m^3$	N.A.
Mineral Spirits	Not Listed	100	Not Listed	Not Listed	50	Not Listed
Stoddard Solvent	1	100	100	350 mg/m^3	50	0.8 to 10.1%
Xylene	Not Listed	100 150 STEL	100 150 STEL	100 150 STEL	50	1.0 to 7.0%

Notes:

[a] Odor Thresholds for Chemicals with Established Occupational Health Standards, American Industrial Hygiene Association, 1989, Range of All Reference Values
[b] 29 CFR 1910.1000, Table Z-1-A. Limits For Air Contaminants, as amended through 1/15/91. (PEL = Permissible Exposure Limit)
[c] 1990 - 1991 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference for Governmental Industrial Hygienist. (STEL = Short Term Exposure Limit)
[d] NIOSH Pocket Guide to Chemical Hazards, June 1990. (REL = Recommended Exposure Limit)

N.A. — Substance information not available, or substance unlisted.
NIOSH — National Institute of Occupational Safety and Health.

Material Safety Data Sheets (MSDS) for these materials are included in Attachment A.

5.0 OPERATIONS AND PHYSICAL HAZARDS

Physical hazards typically encountered during environmental investigations will be present at this site. These hazards include heat-related illnesses, uneven terrain, slippery surfaces, lifting, and use of heavy equipment. The Site Supervisor and Site Health and Safety Officer shall be aware of the potential for heat stress and other weather-related illnesses, and as necessary, implement appropriate work regimens to minimize the likelihood of field personnel becoming ill.

Heavy equipment and drill rig operations will be conducted in accordance with the procedures outlined in the CHASP, Attachment B, Drilling Safety Guide. When conducting operations or survey work on foot, personnel will walk at all times. Running greatly increases the probability of slipping, tripping, and falling. If working in areas supporting habitat for poisonous snakes, personnel should wear protective chaps made of a heavy material designed to prevent snake bites to the legs.

6.0 EMPLOYEE PROTECTION

Employee protection for this project includes standard safe work practices, NAS Memphis rules of conduct, personal protective equipment (PPE), personal decontamination procedures, and equipment for extreme weather conditions, work limitations, and exposure evaluation.

6.1 Standard Safe Work Practices:

- Eating, drinking, chewing gum or tobacco, smoking, or any activity that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated as contaminated, unless authorized by the Site Health and Safety Officer.

- Hands and face must be thoroughly washed upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate or discolored surfaces, or lean, sit, or place equipment on drums, containers, or on soil suspected of being contaminated.

- Medicine and alcohol can exacerbate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on cleanup or response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Consumption of alcoholic beverages is prohibited.

- Due to the possible presence of overhead power lines, adequate side and overhead clearance should be maintained to ensure that the drill rig boom does not touch or pass close to any overhead lines.

- Due to the possible presence of underground utilities (including electric, natural gas, water, sewer, telephone, etc.), the activity and local utility representatives should be contacted and requested to identify all lines at the ground surface using characteristic spray paint or labeled stakes. A 3-yard buffer zone should be maintained during all subsurface investigations.

- Due to the flammable properties of the potential chemical hazards, all spark or ignition sources should be bonded and/or grounded or mitigated before soil boring advancement or other site activities begin.

6.2 NAS Memphis General Rules of Conduct:

- Liquor, firearms, narcotics, tape recorders, and other contraband items are not permitted on the premises.

- Any violation of local, state, or federal laws, or conduct which is outside the generally accepted moral standards of the community is prohibited.

- Violation of the Espionage Act, willfully hindering or limiting production, or sabotage is not permitted.

- Willfully damaging or destroying property, or removing government records is forbidden.

- Misappropriation or unauthorized altering of any government records is forbidden.

- Securing government tools in a personal or contractors tool box is forbidden.

- Gambling in any form, selling tickets or articles, taking orders, soliciting subscriptions, taking up collections, etc. is forbidden.

- Doing personal work in government shop or office, using government property or material for unauthorized purposes, or using government telephones for unnecessary or unauthorized local or long distance telephone calls is forbidden.

- Compliance with posted signs and notices is required.

- Boisterousness and noisy or offensive work habits, abusive language, or any verbal, written, symbolic, or other communicative expression which tends to disrupt the work or morale of others is forbidden.

- Fighting or threatening bodily harm to another is forbidden.

- Defacing any government property is forbidden.

- Wearing shorts of any type and/or offensive logos, pictures, or phrases on clothing is forbidden. Shirts, shoes and pants or slacks, or coverall-type garments will be worn at all times on government property.

- All persons operating motor vehicles will obey all NAS Memphis traffic regulations.

6.3 Selection of Personal Protective Equipment

It is important that PPE be appropriate to protect against the potential or known hazards at each cleanup or investigation site. Protective equipment will be selected based on the types, concentrations, and routes of personal exposure that may be encountered. In situations where the types of materials and possibilities of contact are unknown or the hazards are not clearly identifiable, a more subjective determination must be made of the PPE required, based on past experiences and sound safety practices.

The Project Health and Safety Officer will determine the appropriate level of PPE prior to the initial site entry based on the best available information. PPE requirements are subject to change as site information is updated or changes. **The decision to upgrade or downgrade levels of PPE shall be made by the Project Health and Safety Officer.**

Field activities which disturb soils will be initiated in modified Level D protection except when stated otherwise in the SSHSP or when site conditions (e.g., sampling results from previous studies) indicate that modified Level D is inappropriate. Modified Level D protection consists of a hard hat, appropriate chemical-resistant gloves (vinyl or nitrile), eye protection, and chemical-resistant, steel-toed and shank boots. Work coveralls (full length sleeves and pants) will be worn if free product or contaminants identified as skin irritants are encountered. This level of protection was selected because the concentrations of contaminants detected in previous the studies were low and free product was not detected.

PPE upgrades to Level C will be initiated if airborne concentrations exceed 2 ppm above the background concentration in the breathing zone or if the concentration of any contaminant exceeds 50% of the OSHA Permissible Exposure Limit (PEL). See Table 6-1 for the specific criteria for use and equipment for each level of protection.

6.4 Air Monitoring

Previous site investigations indicate that workers may be exposed to low concentrations of chemicals including VOCs, halogenated compounds, and combustible gases/vapors. Based on site history and existing sampling data, "worst case" contaminated areas will be identified before field activities begin.

Air monitoring using a photoionization detector (PID) and/or other appropriate sampling equipment will be conducted prior to beginning field activities at a new EZ and during ground-disturbing activities. The PID will be field calibrated to measure VOCs relative to a 100 ppm isobutylene standard. If VOCs are detected downhole, colorimetric detector tubes and/or other sampling media may be used to determine the identification and approximate concentration of these compounds.

A combustible gas indicator (CGI) will be used during all soil borings and well installations. The CGI will be field calibrated to measure flammable gases relative to a 23% lower explosive limit (LEL) methane standard. Downhole CGI readings will be collected continuously during all soil disturbing operations. Field activities will immediately cease if downhole readings exceed 10% LEL. If CGI readings do not subside, a careful investigation and mapping of the area will be made. Operations may not proceed until readings are below 10% LEL. The area will be immediately evacuated and the situation re-evaluated to determine how to proceed.

Table 6-1
Level Of Protection And Criteria

Level of Protection	Criteria for Use	Equipment
Level A	• When atmospheres are "immediately dangerous to life and health" (IDLH in the NIOSH/OSHA Pocket Guide to Chemical Hazards or other guides.) • When known atmospheres or potential situations exist that would affect the skin or eyes or be absorbed into the body through these surfaces. Consult standard references to obtain concentrations hazardous to skin, eyes, or mucous membranes. • Potential situations include those where immersion may occur, vapors may be generated, or splashing may occur through site activities. • Where atmospheres are oxygen deficient with the conditions above • When the type(s) and or potential concentration of toxic substances are not known	• Positive pressure-demand full facepiece; self-contained breathing apparatus (SCBA) or positive pressure-demand supplied air respirator with escape SCBA • Totally encapsulating chemical protective suit • Chemical-resistant inner and outer gloves • Steel-toe-and-shank chemical resistant boots • Hard hat under suit • Two-way radios worn inside suit • Coveralls, long cotton underwear, disposable protective suit, gloves and boots, worn over fully encapsulating suit
Level B	• When work areas contain less than 19.5% oxygen • When vinyl chloride is detected in the breathing zone	• Chemical resistant clothes, long sleeves, hooded, one or two pieces • Full-faced positive-pressure demand supplied air breathing apparatus or airline system with a 30-minute escape bottle • Hard hat • Inner gloves and chemical resistant gloves • Steel-toe-and-shank boots • Coveralls and disposable outer boots
Level C	• When airborne dust particles warrant respiratory protection • When work areas contain at least 19.5% oxygen	• Chemical resistant clothes, long sleeves, hood optional, one or two pieces • Full-face piece, air purifying respirator equipped with cartridges suitable for the hazard • Hard hat • Inner gloves and chemical resistant gloves • Steel-toe-and-shank boots • Coveralls and disposable outer boots
Level D	• When level B or C is not indicated • When airborne particles do not warrant respiratory protection • When work areas contain at least 19.5% oxygen	• Inner gloves and chemical-resistant gloves needed to handle soil or water samples • Steel-toe-and-shank boots • Hard hat (ANSI Z891-1969 standard) • Eye protection (ANSI Z87.1-1968) standard • Sunscreen (sun protection factor 15 or greater) • Coveralls and disposable outer boots

Notes:

Level A protection will be selected when the highest available level of respiratory, skin, and eye protection is needed. Level A protection will be required in Area A of the exclusion zone.

Contraindications for use of Level A:
- Environmental measures contiguous to the site indicate that air contaminants do not represent a serious dermal hazard.
- Reliable, accurate historical data do not indicate the presence of severe dermal hazards.
- Open, unconfined areas.
- Minimal probability of vapors or liquids (splash hazards) present which could affect or be absorbed through the skin.
- Total vapor readings indicate 500 ppm to 1,000 ppm.

Level B protection will be selected when the highest level of respiratory protection is needed, but cutaneous exposure to the small unprotected areas of the body, (neck and back of head) is unlikely, or where concentrations are not known to be within acceptable standards. Additionally, the permissible limit for exposure to mixtures of all site gases will be checked using the requirements of 1910.1000(d)(2)(i) to ensure that PEL is not exceeded. If the value calculated using this method exceeds 1.0, Level B PPE is required.

Level C protection will be selected when the types and concentrations of inseparable material are known, or reasonably assumed to be no greater than the protection factors associated with air-purifying respirators, and exposure to the unprotected areas of the body is unlikely to cause harm. Dust concentrations require Level C PPE, where the respirable fractions exceed the PEL of 5 mg/m3 or the total concentrations exceed the PEL of 15 mg/m3.

Level D protection will be chosen when measurements of atmospheric concentrations are at background levels and work functions preclude splashes, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemicals.

If breathing zone levels exceed 2 ppm above background or site conditions indicate that additional health and safety precautions are needed, field activities in the area shall stop. Field staff shall notify the Site Supervisor of the situation and he/she shall contact both the Project Manager and the Project Health and Safety Officer. The Project Health and Safety Officer will be responsible for reassessing the hazards and prescribing revised health and safety requirements as necessary, including upgraded PPE requirements, revised work schedules, and revised decontamination procedures. (Typically, PPE will be upgraded to Level C assuming that cartridge respirators are appropriate, otherwise Level B.) See Table 6-1 for specific criteria for each protection level. Work shall not proceed until breathing zone levels return to background levels and it is reasonably anticipated that breathing zone samples will stay approximately at background levels, or the chemical constituent(s) are identified and appropriate PPE is donned.

Field monitoring values will be recorded in a field logbook and copies must be posted for field personnel review.

On a daily basis, PIDs, CGIs, and other monitoring equipment shall be calibrated or their proper function verified before being used. Throughout the day this equipment shall be periodically checked to ensure that it is working properly. A final calibration shall be conducted at the end of the work day, at which time each instrument will be checked to ensure that it is free from surface contamination. Field staff shall note in their field notebooks that they conducted these calibrations and checks and note whether the equipment was or was not functioning properly. When equipment is not functioning properly it should be brought to the attention of the Site Supervisor or Site Health and Safety Officer who will arrange for repairs and/or replacement of that equipment as needed.

6.5 Procedures and Equipment for Extreme Hot or Cold Weather Conditions

See CHASP Section 7.5.5.

Severe Weather Conditions

All field work shall immediately cease at the first sign of thunder or lightning. Field personnel shall perform emergency personal and equipment decontamination (see Section 6.6) and seek immediate shelter.

6.6 Personal Decontamination

A CRZ will be established immediate to each sampling/boring site and will include a station for decontaminating equipment and personnel. The CRZ will be covered with sheets of 6-mil polyethylene (typically an area 20 feet x 20 feet is sufficient) with specific stations that will accommodate the removal and disposal of the protective clothing, boot covers, gloves, and respiratory protection if required.

As a general rule, equipment will be decontaminated using a soap and clean water wash solution. Equipment decontamination will be completed by personnel in Level D PPE. In the event of inclement weather (e.g., lightning) or an emergency requiring immediate evacuation, all contaminated equipment will be wrapped and taped in 6-mil polyethylene sheeting and tagged as "contaminated" for later decontamination.

Personnel working in the CRZ will be in one Level of PPE lower than personnel in the EZ. For example, if personnel in the EZ are in Level B, decontamination workers will be in Level C.

6.6.1 Personal Decontamination Procedures

The decontamination procedures, based on modified Level D protection, will consist of the following:

- Brush heavily soiled boots and rinse outer gloves and boots with soap and water.
- Remove outer gloves and deposit them in a labeled plastic-lined container.
- Remove outer chemical protective clothing.
- Wash and rinse inner gloves.
- Wash hard hats and eye protection thoroughly at the end of each work day with a soap and water solution.
- Dispose of gloves and other disposable clothing in sealable bags and place in a labeled 55-gallon drum for disposal.
- All field personnel are instructed to shower as soon as possible after leaving the site.

Decontamination procedures will be conducted at the lunch break and at the end of each work day. If higher levels of PPE are needed, adjustments will be made to these procedures, and an amendment will be made to this SSHSP.

All wastes (soil and water) generated during personal decontamination will be collected in 55-gallon drums. The drums will be labeled by USGS personnel for final disposal by the Navy.

6.6.2 Closure of the Personal Decontamination Station

All disposable clothing and plastic sheeting used during site activities will be double-bagged and disposed of in a labeled refuse container. Decontamination and rinse solutions will be placed in a labeled 55-gallon drum for later analysis and disposal. All washtubs, pails, buckets, etc., will be washed, rinsed, and dried at the end of each workday.

6.7 Work Limitations

All site activities will be conducted during daylight hours only. All personnel scheduled for these activities will have completed initial health and safety training and actual field training as specified in 29 CFR 1910.120(e). All supervisors must complete an additional 8 hours of training in site management. All personnel must complete an 8-hour refresher training course on an annual basis in order to continue working at the site.

6.8 Exposure Evaluation

All personnel scheduled for site activities will have had a baseline physical examination and have been declared fit for duty. The exam includes a stressing exam of the neurologic, cardiopulmonary, musculoskeletal and dermatological systems, pulmonary function testing, multi-chemistry panel and urinalysis. An exposure history form will be completed for each worker participating in site activities. An examination and updated occupational history will be repeated on an annual basis and upon termination of employment as required by 29 CFR 1910.120(f). The content of the annual or termination examination will be the same as the baseline physical. A qualified physician will review the results of the annual examination and exposure data and request further tests or issue medical clearances as appropriate.

After any job-related injury or illness, there will be a medical examination to determine fitness for duty or any job restrictions. The Site Health and Safety Officer will review the results with the examining physician before releasing the employee for work. A similar examination will be performed if an employee has missed at least three days of work due to a non-job related injury or illness requiring medical attention. Medical records shall be maintained by the employer or the physician for at least 30 years following the termination of employment.

7.0 MEDICAL MONITORING PROGRAM

See CHASP Section 7.6.

8.0 AUTHORIZED PERSONNEL

Personnel anticipated to be onsite at various times during site activities include:

- Principal-In-Charge — Dr. James Speakman (E/A&H)
- Task Order Manager/Project Manager — Mr. Lawson Anderson (E/A&H)
- Project Health & Safety Officer — Mr. Doug Petty (E/A&H)
- Field Environmental Scientist — Mr. Robert Smith (E/A&H)
- Field Environmental Scientist — Ms. Alison Choate (E/A&H)
- Engineer-in-Charge — Mr. Mark Taylor (SOUTHDIV)
- USGS Personnel — Mr. William Parks, Mr. Jack Carmichael, Mr. James Kingsbury
- Naval Air Station Memphis, Tennessee Site Contact — Ms. Tonya Barker

8.1 Responsibilities of Site Supervisor

The Site Supervisor will direct the site operations and, relative to health and safety, is responsible for assuring that:

- Field staff follow the CHASP, SSHSP, and other safety and health standard operating procedures (SOPs). Personnel that do not comply are retrained and/or instructed to leave the site and not allowed to return.

- Field staff have current HAZWOPER training.

- Field staff know who the Site Health and Safety Officer is.

- Field staff know the site specific safety and health concerns.

- There is an adequate onsite supply of health and safety equipment.

- Field staff participate in the E/A&H Medical surveillance program (or in the case of the USGS or subcontractors, an equivalent program).

- Field staff attend safety and health "kick-off" orientation and other site safety briefings.

The Site Supervisor is also responsible for assuring that field staff who may be exposed to unique or special hazards have the training or experience necessary to safely conduct their work.

8.2 Responsibilities of Site Health and Safety Officer

The responsibilities of the Site Health and Safety Officer include:

- Providing the Site Supervisor technical input on site health and safety issues.

- Observing field personnel and reporting to the Site Supervisor on the effectiveness of the CHASP and SSHSP and whether field staff are utilizing proper work practices and decontamination procedures.

- Reporting significant safety violations to the Project Manager and/or Project Health and Safety Officer.

- Conducting safety briefings during field activities.

- Assuring that copies of the CHASP and SSHSP are maintained onsite during all field activities.

- Maintaining a file of HAZWOPER training certificates and appropriate refresher training certificates for onsite personnel.

The Site Health and Safety Officer will have the following qualifications: (1) 40 hours OSHA training or equivalent experience, (2) 24 hours of supervisory training or equivalent experience, (3) knowledge of the health and safety concerns for the specific work tasks being conducted, and (4) shall be trained to use the air monitoring equipment; be able interpret the data collected with the instruments; be familiar with symptoms of chemical exposure, heat stress and cold exposure, and know the location and proper use of onsite safety equipment. He will also be familiar with the CHASP and SSHSP.

The position of Site Health and Safety Officer may rotate. Often, particularly on small projects, this function is not a full time responsibility, rather a member of the field team is selected to serve as the Site Health and Safety Officer. Then when that task is completed and/or field staff change, the Site Health and Safety Officer may change as well.

The following criteria outline when the Site Health and Safety Officer will be replaced: (1) termination of employment, (2) end of work task, (3) end of shift, (4) sickness, (5) injury, or (6) death. It should be noted that under site work schedules only one shift will be working. As a result, the Site Health and Safety Officer will be responsible for the day shift. If circumstances arise that require work during other periods, an alternate Site Health and Safety Officer will be designated.

8.3 Responsibilities of Onsite Field Staff

The health and safety responsibilities of field staff include:

- Being familiar with and complying with the CHASP and SSHSP.
- Attending site health and safety briefings and being aware of anticipated chemical, physical, and biological hazards and what to do when these hazards are encountered.
- Being properly trained on PPE to be used, safety work practices, decontamination procedures to be followed, and emergency procedures and communications.
- Utilizing required PPE including respiratory protective.
- Having up to date HAZWOPER training and providing the Site Supervisor with documentation that their training is current.
- Being an up to date participant in an acceptable medical surveillance program.
- Being fit-tested and physically capable of using a respirator and being in a position where using a respirator may be a requirement. Should the use of respiratory protection be required, field workers shall not have facial hair which intrudes into the sealing surface of the respirator.

- Using the buddy system when wearing respiratory protective equipment. When working in Level C or higher, a third person shall be at the work area. This person shall be suitably equipped to provide logistical and safety support to the entry team.

In addition, field staff should always be alert and use their senses (sight, smell, etc.) to identify and react to potentially dangerous situations. When working in the EZ, visual contact should be maintained between personnel; field personnel should be close enough to assist each other during an emergency. Procedures for leaving a contaminated area must be planned and implemented before going onsite in accordance with the CHASP and SSHSP.

The number of personnel and equipment in the contaminated area should be kept to a minimum, consistent with effective site operations. All visitors to the job site must comply with the CHASP and SSHSP procedures. PPE may be modified for visitors depending on the situation. Modifications must be approved by the Project Health and Safety Officer.

9.0 EMERGENCY INFORMATION

All hazardous waste site activities present a potential risk to onsite personnel. During routine operations risk is minimized by establishing good work practices, staying alert, and using proper PPE. Unpredictable events such as physical injury, chemical exposure, or fire may occur and must be anticipated.

If any situation or unplanned occurrence requires outside or support service, Tonya Barker, NAS Memphis Site Contact, will be informed and the appropriate contact from the following list will be made:

Contact	Agency or Organization	Telephone
Tonya Barker	NAS Memphis	(901) 873-5461/5462
Mark Taylor	SOUTHDIV EIC	(803) 743-0573
Law Enforcement	NAS Memphis Base Security	9-911
Fire Department	NAS Memphis	9-911
Ambulance Service	Naval Hospital, Millington Navy Road	(901) 873-5801/5802 or 9-911
Hospital	Methodist North Hospital 3960 Covington Pike	(901) 372-5211 or 9-911
Southern Poison Control Center	—	(901) 528-6048
Lawson Anderson	EnSafe/Allen & Hoshall	(901) 372-7962
Doug Petty	EnSafe/Allen & Hoshall	(901) 372-7962

Mark Taylor, SOUTHDIV Engineer-in-Charge (EIC) will be contacted after appropriate emergency measures have been initiated onsite.

9.1 Site Resources

Cellular telephones may be used for emergency use and communication/coordination with NAS Memphis. First aid and eye wash equipment will be available at the work area.

9.2 Emergency Procedures

Conditions which may constitute an emergency include any member of the field crew being involved in an accident or experiencing any adverse effects or symptoms of exposure while onsite or if a condition is discovered that suggests the existence of a situation more hazardous than anticipated.

The following emergency procedures should be followed:

- Site work area entrance and exit routes will be planned and emergency escape routes delineated by the Site Health and Safety Officer. Copies of the emergency contacts and routes will be posted onsite.

- If any member of the field team experiences any effects or symptoms of exposure while on the scene, the entire field crew will immediately stop work and act according to the instructions provided by the Site Health and Safety Officer.

- For applicable site activities, wind indicators visible to all onsite personnel will be provided by the Site Health and Safety Officer to indicate possible routes for upwind escape.

- The discovery of any conditions that would suggest the existence of a situation more hazardous than anticipated will result in the suspension of work until the Site Health and Safety Officer has evaluated the situation and provided the appropriate instructions to the field team.

- If an accident occurs, the Field Project Manager is to complete an Accident Report Form (See Attachment C) for submittal to the managing principal-in-charge of the project.

- If a member of the field crew suffers a personal injury, the Site Health and Safety Officer will call **(901) 372-5211 or 9-911** (serious injury) to alert appropriate emergency response agencies or administer onsite first aid (minor injury) as the situation dictates. An Accident Report Form will be completed for any such incident.

- If a member of the field crew suffers chemical exposure, the affected areas should be flushed immediately with copious amounts of clean water, and if the situation dictates, the Site Health and Safety Officer should alert appropriate emergency response agencies, or personally ensure that the exposed individual is transported to the nearest medical treatment facility for prompt treatment. (See Attachment D for directions to the emergency medical facility.) An Accident Report Form will be completed for any such incident.

Additional information on appropriate chemical exposure treatment methods will be provided through Material Safety Data Sheets (MSDS) in Attachment A.

10.0 FORMS

The following forms will be used to implement this Health and Safety Plan:

- Plan Acceptance Form
- Plan Feedback Form
- Exposure History Form
- Accident Report Form

The Plan Acceptance Form will be filled out by all employees working on the site before site activities begin. The Plan Feedback Form will be filled out by the Site Safety Officer and any other onsite employee who wishes to fill one out. The Exposure History Form will be completed by both the Field Project Manager and the individual(s) for whom the form is intended. Examples of each form are provided in Attachment C of this plan.

All completed forms must be returned to the Task Order Manager at EnSafe/Allen & Hoshall, Memphis, Tennessee.

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Attachment A

Material Safety Data Sheets

Attachment B

Drilling Safety Guide

Attachment C

Health and Safety Plan Forms

PLAN ACCEPTANCE FORM

PROJECT HEALTH AND SAFETY PLAN

INSTRUCTIONS: This form is to be completed by each person working on the project site and returned to: EnSafe/Allen & Hoshall, Memphis, Tennessee.

Job No: CTO — 106

Contract No: N62467-89-D-0318

Project: SWMU 14 — Former Building S-140 Site and Seventh Avenue Ditch

I have read and understand the contents of the above plan and agree to perform my work in accordance with it.

____

Signed

____

Print Name

____

Company

____

Date

EMPLOYEE EXPOSURE HISTORY FORM

Employee: ____

Job Name: ____

Date(s) From/To: ____

Hours On Site: ____

Contaminants (Suspected/Reported):

____

____

____

____

____

____

____

____

____

____

____

____

(See Attached Laboratory Analysis)

PLAN FEEDBACK FORM

Problems with plan requirements:

Unexpected situations encountered:

Recommendations for revisions:

ACCIDENT REPORT FORM

SUPERVISOR'S REPORT OF ACCIDENT	DO NOT USE FOR MOTOR VEHICLE OR AIRCRAFT ACCIDENTS
TO	FROM TELEPHONE (Include area code)
NAME OF INJURED OR ILL WORKER AND COMPANY	
WORKER'S SOCIAL SECURITY NUMBER	

DATE OF ACCIDENT	TIME OF ACCIDENT	EXACT LOCATION OF ACCIDENT

NARRATIVE DESCRIPTION OF ACCIDENT

NATURE OF ILLNESS OR INJURY AND PART OF BODY INVOLVED	LOST TIME YES ☐ NO ☐

PROBABLE DISABILITY (Check one)

FATAL ☐	LOST WORK DAY WITH _____DAYS AWAY FROM WORK	LOST WORK DAY WITH _____DAYS OF RESTRICTED ACTIVITY	NO LOST WORK DAY ☐ FIRST-AID ONLY ☐

CORRECTIVE ACTION RECOMMENDED (By whom and by when)

NAME OF SUPERVISOR (Print)	TITLE
	DATE

Attachment D

Directions to Emergency Medical Facilities

DIRECTIONS TO THE NEAREST MEDICAL FACILITIES

The nearest hospital **and** the nearest facility capable of treating chemical burns are the same facility, which is located at Methodist North Hospital. Therefore, there is only one set of directions.

Nearest Hospital
Methodist North Hospital **3960 Covington Pike** **Memphis, Tennessee**
Emergency Room Telephone Number — (901) 372-5211

Directions to Methodist North Hospital from NAS Memphis Main Gate:

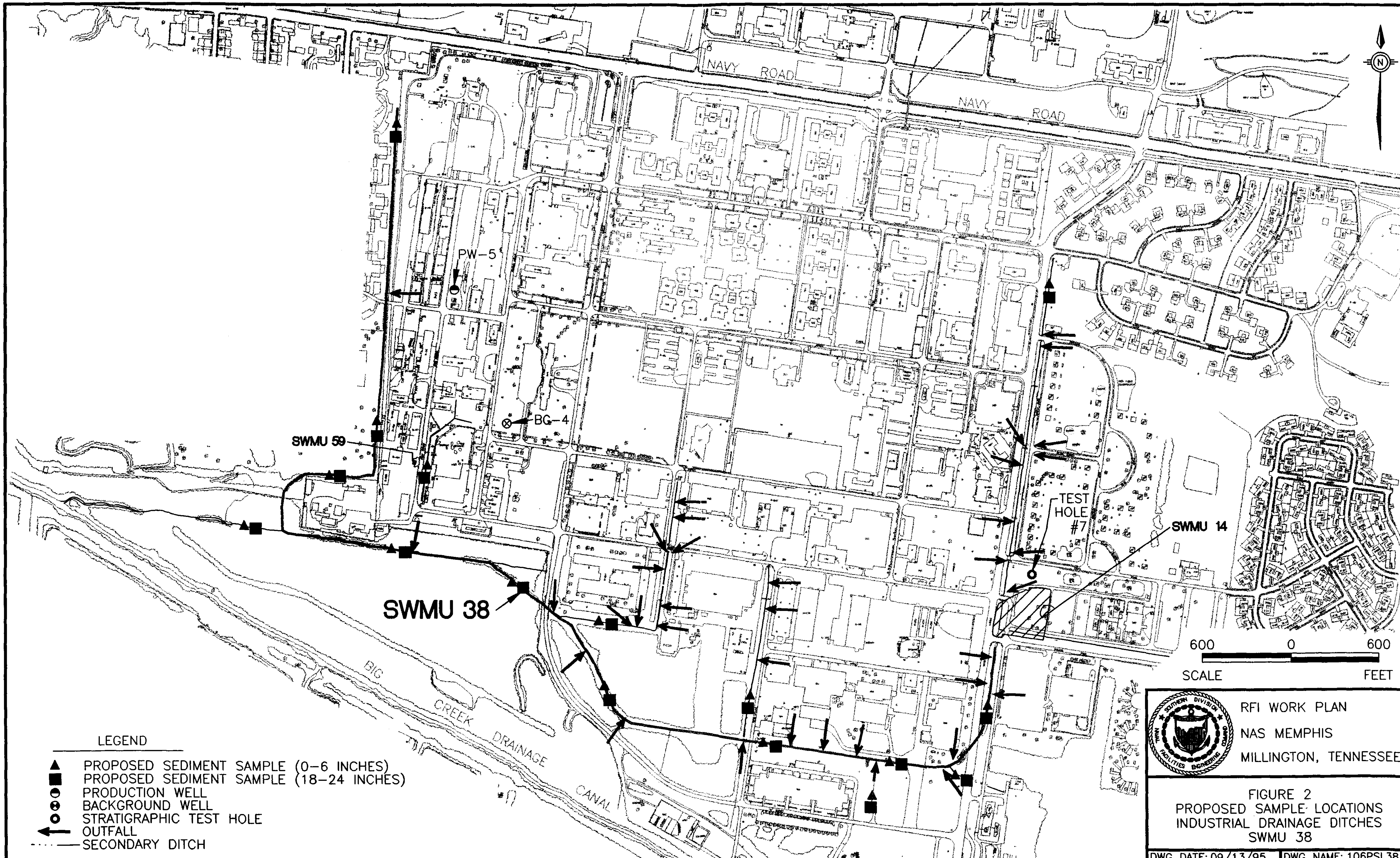
1) Exit site through South Gate (Singleton Parkway).

2) Continue on Singleton Parkway through the stop signs.

3) Singleton Parkway and Covington Pike will intersect at a red light (about 5 miles).

4) You will see the entrance to the emergency room 700 feet past this light on the left.

INSERT MAP TO HOSPITAL


NAVY ROAD
NAVY ROAD
PW-5
BG-4
SWMU 59
SWMU 38
TEST HOLE #7
SWMU 14
BIG CREEK DRAINAGE CANAL
600 0 600
SCALE
FEET
LEGEND
PROPOSED SEDIMENT SAMPLE (0-6 INCHES)
PROPOSED SEDIMENT SAMPLE (18-24 INCHES)
PRODUCTION WELL
BACKGROUND WELL
STRATIGRAPHIC TEST HOLE
OUTFALL
SECONDARY DITCH
RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TENNESSEE
FIGURE 2
PROPOSED SAMPLE LOCATIONS
INDUSTRIAL DRAINAGE DITCHES
SWMU 38
DWG DATE: 09/13/95
DWG NAME: 106PSL38

SOURCE: U.S. NAVY

RFI WORK PLAN
NAS MEMPHIS
MILLINGTON, TN.

FIGURE 1
LAND SURFACE ELEVATION MAP
SOUTHSIDE OF NAS MEMPHIS

Dr by: E/AH	Tr by: E/AH	
Ck by: A. CHOATE	App by: E/AH	Sheet 1
Date: 12/28/95	DWG Name: 106LSETS	Of 1

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